

APPENDIX D  
USER'S MANUAL FOR SIDE IMPACT DUMMY (SID)  
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## **1.0 DISASSEMBLY, INSPECTION AND ASSEMBLY**

### **1.1 Introduction**

This section contains detailed step-by-step instructions on assembly and disassembly of the SID and includes items that should be specifically inspected for proper functioning of the dummy in side impact testing. The sequence of disassembly or assembly is largely a matter of preference and reflects experience based on dummy users at the Vehicle Research and Test Center (VRTC) in East Liberty, Ohio. Other users may find different procedures more suitable for their purposes.

The major features of the side impact dummy (Figure 1) are as follows:

- A. The head, neck and neck bracket are from the standard Part 572B 50th percentile adult male dummy.
- B. The thorax is totally unique from the bottom of the neck bracket to the top of the lumbar spine.
- C. The pelvis is unique to the Part 572F dummy (SID).
- D. The legs also are from the Part 572B dummy with the exception of the link rods which have been modified to incorporate femur posts to permit motion laterally of the knee casting relative to the upper leg.
- E. The mandatory instrumentation for compliance tests include one accelerometer mounted at the base of the thoracic spine ( $T_{12}$ ), accelerometers mounted at the upper (LUR or RUR) and lower (LLR or RLR) ends of the rib bar, and an accelerometer mounted in the pelvis (PEV). Provisional for optional instrumentation include the mounting of accelerometers in the head and at T1.

The drawing package for the side impact dummy is with revisions as of June 1990. The bill of materials, extracted from that drawing package, is included in this manual. It does not in any way supersede the bill of materials contained in the drawing package.

## **1.0 DISASSEMBLY, INSPECTION AND ASSEMBLY....Continued**

### **1.2 Tools Required**

The tools are the same as those used to assemble the Part 572B dummy. The only additional tool required to work on the Side Impact Dummy is a spanner wrench to remove the nut that mounts the ACE Thorax Shock Absorber to its mounting bracket.

### **1.3 Disassembly and Inspection**

Every newly purchased SID should be disassembled and checked against the applicable drawing package. Particular attention should be paid to the following:

- A. Ribs should be checked to insure that they meet the drawing package specifications. Hardness of the steel specifications are critical and should be measured at designated locations.
- B. Inspect for proper arm foam and rib wrap foam.
- C. The shock absorber mounts fit as shown in drawing package.
- D. Anti-Sag device should be adjusted to set rib cage height to correct dimensions. (See Section 2.2).
- E. Rib cage hinge material must be per drawing specifications and with the correct fiber orientation as shown on drawing SID-033.
- F. Shock absorber is to be checked to assure that the oil chambers are free of air bubbles.
- G. All fasteners must be tightened as specified (see Section 1.6).
- H. Upper legs and knee posts are installed to meet requirements of Section 1.8.
- I. Lumbar spine cable is torqued to give the spine the correct height as specified in Section 1.3.09.

## **1.0 DISASSEMBLY, INSPECTION AND ASSEMBLY....Continued**

The procedure described in the following sections should be used to assure that the newly purchased SID will perform properly in side impact tests. This procedure will also provide the basis to verify the dynamic component responses of the dummy during testing.

### **1.3.01 Chest Jacket and Arm Foam**

The chest jacket (SID-066) has a full length zipper front and back (Figures 2 and 3). Unzip both zippers to remove chest skin from thorax. Slide each half laterally from the dummy. The dummy will need to be held by one hand at the top of the head and tipped away from the direction in which the chest skin half is being removed (Figure 4). The chest jacket has an inside shelf which overlaps the abdominal insert and covers rib cage (Figure 5). Examine the torso skin to make sure there are no cuts or tears and that the zipper mounting is not coming loose.

With the chest jacket removed check to see that the arm foam padding is in place (Figure 5).

### **1.3.02 Head and Neck**

With the torso jacket removed, disengage the four 1/4-20 socket head cap screws (SHCS) from the skull cap to remove cap from the skull (Figure 6). Remove the two 1/4-20 flat head screws from the floor of the skull to remove the head from the neck (Figure 7).

Next, remove the four 5/16-18 SHCS by moving back the shoulder foam SID-050 and SID-051 enough to reach the four SHCS (Figure 8). The neck bracket, along with the neck can then be removed by removing the three 1/4-20 SHCS at the base of the neck. Separate the neck from the neck bracket (Figure 9).

## 1.0 DISASSEMBLY, INSPECTION AND ASSEMBLY....Continued

### 1.3.03 Shoulder Foam and Abdomen

After the neck bracket screws have been removed, separate the anti-sag device #10-32 lock nut (SID-053) from the shoulder plate (SID-063) (Figure 10). The shoulder plate (SID-063) will also come off the thoracic spine at this time (Figure 11). The shoulder assembly consists of the following:

Shoulder plate	SID-063
Upper shoulder foam	SID-051
Middle shoulder foam	SID-050
Lower shoulder foam	SID-052
6-bolts	SID-073, line 1
12 washers	SID-075, line 3
6 nuts	SID-074, line 1
(See Figure 12)	

The six bolts and nuts will be removed to disassemble the shoulder assembly. Inspect each piece of foam for cuts, tears, deterioration, etc. The shoulder plate should be inspected for deformation. Upon assembly, the six bolts should be tightened only enough to keep the foam from separating; not tight enough to deform the foam.

Remove and examine the abdominal insert for skin to foam separation and for tears and/or cuts in the vinyl skin and replace if needed (Figure 13).

### 1.3.04 Anti-Sag Device

The Anti-Sag device, shown in SID-053, is mounted to the shoulder plate (SID-063) by one lock nut (Figure 10) at the top and at the bottom by a hair pin cotter (Figure 14). To remove the Anti-Sag device, first remove lock nut from the shoulder plate as discussed before, then remove hair pin cotter and remove assembly from the thorax. The assembly consists of one spring, an upper and lower link, and two draw bars (Figure 15).

## **1.0 DISASSEMBLY, INSPECTION AND ASSEMBLY....Continued**

### **1.3.05 Rib Wrap Assembly**

The rib wrap assembly (SID-040) consists of the outer rib pad (SID-041), the inner rib pad (SID-042), the washer strip (SID-043), and the urethane rib wrap (SID-044) (Figure 16). Remove the four #10-32 socket head cap screws and nuts from each corner of the hinge which holds rib wrap to thorax (Figure 17). Remove rib wrap from around the rib cage (Figure 18). Inspect foam and urethane for tears and deterioration of foam.

### **1.3.06 Ribs, Sternum, Rib Bar and Hinge**

The SID thorax can be changed for either left or right impacts. All figures in this manual depict the SID configuration for a LEFT SIDE IMPACT.

With the anti-sag device and rib wrap removed, the ribs can be disassembled from the thoracic spine box. Before ribs can be removed and inspected, first remove the 5/16-24 locknut shown in (SID-053) from shaft (SID-061-1) (Figure 19). When removing shaft (SID-061-1) from clevis (SID-062), make sure not to lose spacers (SID-061-2). With the shaft removed, the damper assembly is free from the rib assembly.

Remove the twelve #10-32 socket head cap screws which mount the hinge mounting block (SID-034), and hinge (SID-033) to thoracic spine box (SID-004) (Figure 20). With these 12 bolts removed, the hinge mounting block can be removed as well as the rib assembly mounted to the hinge.

Remove the 10 #10-32 SHCS on either side of hinge to separate hinge from ribs (Figure 21). With the 10 screws removed from either side of the hinge the two hinge nut bars (SID-035) can be removed. Inspect for cracks or any deterioration.

Remove and inspect the four rib ballasts attached to the ribs (Figure 16). Remove the five #6-32 SHCS which attach the rib ballast (SID-25) to the rib assembly (Figure 22). Remove with rib ballast assembly five rib cushions (SID-029) (Figure 23). Repeat for each rib ballast assembly front and rear, (SID-025 & SID-026).

## 1.0 DISASSEMBLY, INSPECTION AND ASSEMBLY....Continued

Remove the 10 #6-32 SHCS on either side of rib assembly to remove the rib bar (SID-024) from the ribs (SID-018) (Figure 24). When removing the rib bar, also remove the rib bar cushions (SID-085) (Figure 25). Rib bar (SID-024) will have clevis (SID-062), and rib bar ballast (SID-028) mounted to it on one side of ribs (Figure 26) and have only the rib bar ballast (SID-027) mounted on the opposite side of the rib cage depending which way the damper is installed. The clevis (SID-062) is installed toward the impacted side of the dummy. The ballasts (SID-027 & 028) are cut to fit around the flanges of the clevis (Figure 26).

Remove the four #8-32 flat head screws to remove rib ballast (SID-027 or SID-028). Remove the two #10-32 flat head screws to remove clevis (SID-062).

On the impact side of the dummy, four Y-direction 7264-2000g Endevco accelerometers can be mounted to rib bar (SID-024) (Figure 26). Two accelerometers are mounted at the top and two at the bottom of the rib bar. Only primary accelerometers are mandatory.

Remove the ten 1/4-28 nuts from the inside of the sternum (Figure 27). Next, remove the upper and lower washer bars, (SID-031). Next, remove the two 1/4-28 nuts from the outside of the sternum (Figure 18). Remove rib cage support angle, now in a new place, (SID-032) (Figure 28). Remove top, middle, and bottom sternum ballast from sternum (Figure 29). Remove urethane sternum plate (SID-021) from the ten 1/4-28 bolts (Figure 29). With sternum plate removed, rib number 1 at the top and rib number 5 at the bottom will no longer be connected to the ribs 2 through 4 (Figure 30). Remove the twenty 1/4-28 SHCS from ribs which bolt into the top and bottom sternum bars (SID-022) and the center sternum bar (SID-020) (Figure 30). This will separate the individual ribs and sternum bars.

Carefully examine each rib and rib damping (SID-018) material for cracks and replace if necessary. Check for gaps or other failures of the epoxy bond between the rib damping material and rib metal. Compare rib dimensions and contours with the specifications shown in Figure 31 (SID-019).

## 1.0 DISASSEMBLY, INSPECTION AND ASSEMBLY....Continued

### 1.3.07 Shock Absorber Mounting Assembly

The SID shock absorber is defined in Section 1.7 and SID-053. With the ribs removed, the shock assembly is only attached to the thoracic spine assembly (SID-004) by the support angle (SID-057) (Figure 32). Remove the two 1/4-20 SHCS from support angle (SID-057) to remove the bracket from the thoracic spine (Figure 33). With shock absorber assembly removed from the spine, (Figure 34) the shock absorber can be separated from the mounting frame (SID-056) by removing the spanner nut from the back of damper gate (SID-054) (Figure 32). An exploded view of the mount assembly consisting of nut (SID-074), support angle (SID-057), washers (SID-058), shock mount (SID-056), flat head (SID-072), damper gate (SID-054), and pivot pins (SID-055) as shown in Figure 35. The disassembly of the optional Bourns pot (SID-089), pot mount bracket (SID-059), and rod end (SID-077) is shown in Figure 35.

### 1.3.08 Thoracic Spine Assembly

Remove the two 1/4-20 SHCS from thoracic spine box (SID-004) to remove the anti-bottoming pad (SID-045) (Figure 36).

Remove the four #10-32 SHCS at the top of the spine ( $T_1$ ) to remove the accelerometer mount plate (SID-036) (Figure 37).

Remove the three 1/4-20 SHCS at the bottom of the spine ( $T_{12}$ ) to remove the accelerometer cover (SID-039) (Figure 38).

Remove the two #4-40 SHCS at the  $T_{12}$  position of the spine to remove the  $T_{12}$  accelerometer mount (SID-038) (Figure 39).

Remove the three 5/16-18 SHCS from the lumbar adaptor (SID-006) to remove thoracic spine from lumbar spine (Figure 40).



## 1.0 DISASSEMBLY, INSPECTION AND ASSEMBLY....Continued

### 1.3.09 Lumbar Spine and Pelvic Adaptor

Remove the two 5/16-18 SHCS from the inside of the lumbar adaptor (SID-006) (Figure 41), and remove lumbar adaptor from the lumbar spine (SID-002).

Remove the four 3/8-16 SHCS from lumbar pelvic adaptor (SID-088) (Figure 42), and remove lumbar spine and pelvic adaptor assembly from the pelvis. Inspect lumbar spine for evidence of cracks and correct height of 131 mm  $\pm$  1.5 mm (5.15"  $\pm$  0.06") with cable torqued (Figure 43).

To separate the lumbar spine from the lumbar pelvic adaptor remove the three 1/4-20 SHCS from the bottom of the adaptor bolting the bottom of the spine to the top of the adaptor.

### 1.3.10 Pelvis Assembly

To separate legs from pelvis (SID-087) remove the two 1/2-13 shoulder bolts from upper femurs (Figure 44). Remove the femur ball and flange assembly (Figure 45), from each side of the pelvis by unscrewing three 1/4-20 SHCS per side. Access is gained through the three 13 mm (0.5") diameter holes in each side of the pelvis. First remove the two rear screws and then rotate the femur assembly towards the pelvic center to allow access to the third screw.

Remove the accelerometer mounting block (SID-090) (Figure 46). Examine to ensure that the accelerometer mount will properly house the desired accelerometer. Examine the pelvis for foam separation, flesh tears and/or cuts. Check the buttock compression by mounting an adaptor to the top of the pelvic-lumbar adaptor interface surface. Invert the pelvis and apply a 334 N (75 lb) force to the bottom of the pelvis, parallel to the ground, through a 406 mm by 406 mm (16" x 16") flat rigid plate covering the entire buttock area. After 10 seconds, the distance between the pelvic lumbar interface surface and the plate must be within the range of 130 mm to 135 mm (5.1" to 5.3").

## **1.0 DISASSEMBLY, INSPECTION AND ASSEMBLY....Continued**

### **1.3.11 Upper Legs and Knee**

Separate the upper leg sections by removing the two 3/8-16 S.H.C.S. (one 45 mm (1.75") long and the other 51 mm (2") long) that secure the upper and lower knee post (SID-078 & 079) assembly in place (Figure 47). NOTE: Upper leg bone should not have the stud bolts used for film targets in place. Inspect knee post assembly to the drawing and make sure it can rotate properly (Figure 48). Separate the lower leg from the knee casting by removing the 10 mm by 76 mm (0.375" x 3") long shoulder bolt (Figure 49).

Disassemble and inspect knee joint for proper operation (Figure 50).

Remove the knee skin and examine for cuts and/or tears. Clean the inside and outside of the insert and adjoining knee skin with alcohol or chlorinated solvent (Figure 51).

### **1.3.12 Lower Legs and Feet**

Separate the foot and ankle assembly by removing the 1/2-20 S.H.C.S. and the 10 mm by 76 mm (0.375" x 1") long shoulder bolt near the foot leg intersection (Figure 52). Inspect all parts.

## **1.4 Accelerometer Placement and Cable Routing**

All instrumentation and sensors used in the SID must conform to the SAE J211 (1980) recommended practice requirements.

Accelerometer orientation is as follows:

At the T<sub>1</sub> position on the thorax spine (SID-004), the mount (SID-037) permits mounting up to 4 accelerometers. Of the 4 accelerometers the lateral-medial (L-M) direction closest to the impact side of the dummy is required for compliance purposes. The one farthest from the impact side may be used for redundant purposes (Figure 53).

The designation and placement of the accelerometers for the T<sub>12</sub> and pelvic accelerometer positions are similar to T<sub>1</sub> (Figures 54 and 46).

## **1.0 DISASSEMBLY, INSPECTION AND ASSEMBLY....Continued**

The upper and lower rib accelerometers which are mounted to the rib bar are to measure acceleration in the L-H direction. Provisions are available to mount two accelerometers at each position (Figure 26). The compliance designated accelerometer is always mounted closest to the sternum. The accelerometer mounted closest to the spine can be used for redundant purposes. The accelerometer wires coming from the accelerometers mounted on the rib bar should have enough strain relief in them before exiting the thorax. Place a cable tie on the ballast on the rib bar so that it is possible to make an approximately 51 mm (2") diameter loop of accelerometer cable and tie it at this point before the cable is routed to the rear of the thorax.

### **1.5 Impact Direction Changeover**

The SID thorax is designed for either right or left side impacts but requires the interchanging of the shock absorber and mounting assembly along with the anti-bottoming pad when switching impact directions. The configuration shown in the above assembly instructions is for a left side impact.

It is not necessary to completely disassemble the chest when making the changeover if one is careful not to stretch the accelerometer cables or let them carry all of the weight of the rib bars. The shock absorber, the mounting brackets, Section 1.3.07, the anti-bottoming pad, Section 1.3.08, and the outer rib wrap, Section 1.3.05, must first be removed. The rib reinforcement plates (SID-030), rib bar cushions (SID-085), and the rib bars (SID-024), must then be removed from the ribs being careful not to let the rib bars hang on the accelerometer cables. The ballasts (SID-027 & 028), and clevis (SID-062) are then removed. The clevis is then switched to the other rib bar and the ballasts are reinstalled. The rib bars and reinforcements are then reattached to the ribs. The anti-bottoming pad and the shock absorber mounting brackets are switched to the opposite sides and bolted to the thorax using the same mounting holes and being sure to use the tapered socket head bolts for the shock mount. The shock absorber assembly and the outer rib wrap are then reinstalled.

### **1.6 Bolt Torques**

This section contains tabulations of the torques applied to nuts, bolts, and screws used in the assembly of the SID. It is necessary to check all connections for looseness as testing proceeds. All other bolts which are Part 572B dummy bolts use torques specified for Part 572B.

**1.0 DISASSEMBLY, INSPECTION AND ASSEMBLY....Continued****BOLT TORQUES**

APPLICATION	TORQUE	
	N•m	IN-LBS
Neck base to thorax	13.6	120
Hinge to thorax	3.4	30
T <sub>1</sub> base to thorax	4.5	40
T <sub>1</sub> accelerometer mount to T base	4.5	40
T <sub>12</sub> accelerometer mount to thorax	0.9	8
T <sub>12</sub> accelerometer cover to thorax	4.5	40
Anti-bottoming pad to thorax	4.5	40
Urethane rib wrap to hinge	N/A	N/A
Accelerometer attachment	0.07	0.6
Ring to potentiometer	N/A	N/A
Pivot pin to gate	N/A	N/A
Rib to hinge	3.4	30
Rib ballast to rib	1.7	15
Rib bar to rib	2.8	25
Rib to center sternum bar	7.9	70

(Continued on next page)

**1.0 DISASSEMBLY, INSPECTION AND ASSEMBLY....Continued**

APPLICATION	TORQUE	
	N•m	IN-LBS
Rib to sternum bar	7.9	70
Lumbar adapter cap to lumbar	11.3	100
Thoracic assembly to lumbar	27.1	240
Shock absorber support angle to thorax	9	80
Shoulder foam to shoulder plate	Sec.1.6	Sec.1.6
Sternum ballast to rib bar	3.4	30
Urethane rib wrap to hinge	N/A	N/A
Potentiometer to rod end bearing	N/A	N/A
Shaft and clevis	2.8	25
Shock absorber frame support	6.8	60
Rib support angle to sternum	2.3	20
Rib bar ballast to rib bar	1.7	15
Rib bar to damper clevis	4.5	40
Rib accelerometer mount to rib bar	0.9	8
Shock absorber frame to support angle	6.8	60
Rib to sternum bar	3.4	30
Shock absorber jam nut	4.5	40

**1.7 Filling and Bleeding Procedure for the SID Thoracic Shock Absorber**

The SID thoracic shock absorber (SID-083) is manufactured by ACE Controls Inc. (or any shock absorber that fulfills performance requirements) and is specified as the following:

HA - ½ x 2-2 ACE Primary Series Linear Decelerator non-adjustable with full open orifices and a double shaft seal.

## 1.0 DISASSEMBLY, INSPECTION AND ASSEMBLY....Continued

The following industrial oils may be used to fill the shock absorber. Oils from different manufactures should not be mixed.

American Industrial oil #46  
AMOCO-Dexron Automatic Transmission Fluid  
Texaco Regal 46

The following draining, flushing, filling and bleeding procedure should be performed before a shock absorber is bench tested to check performance. If the oil to be used in bleeding the unit is the same as the oil already in the unit, it is not necessary to drain and flush the shock absorber.

- A. Remove the spring retainer screw, the spring retainer, and the spring from the shaft.
- B. Replace the retainer and the retainer screw.
- C. Remove the drain plug (socket head) and the bleed screw from the shock absorber body.
- D. Drain the oil from the unit.
- E. Check the bleed hole to see if it is clear. If there is black foam blocking the hole, the unit must be disassembled and the foam moved out of the way. See the ACE Controls Installation, Maintenance and Repair manual for disassembly instructions.
- F. Screw a standpipe and reservoir into the drain plug opening. A short nipple with a pipe thread on one end and a small cup [approximately 51 mm (2") in diameter and 51 mm (2") high] soldered to the other end is satisfactory.
- G. Fill the cup with clean oil and stroke the piston several times until oil is flowing freely out of the bleed hole. Remove the cup and drain the oil from the shock absorber. Repeat this flushing three times.

**1.0 DISASSEMBLY, INSPECTION AND ASSEMBLY....Continued**

- H. Replace the cup and refill it with clean oil. Stroke the unit several times until oil is flowing freely out of the bleed hole. With the piston fully stroked, place a thumb or finger tightly over the bleed hole and draw the piston out slowly. Oil will be drawn in through the stand pipe. Remove the finger and push the piston in slowly forcing oil and air bubbles out of the bleed hole. Be sure there are no air bubbles or contaminants in the reservoir or they will be drawn into the unit. Keep the reservoir full of clean oil. Never pull the shaft out without tightly covering the bleed hole or air will be drawn into the unit. Continue stroking the shock absorber slowly until no air bubbles can be seen emerging from the bleed hole. Even very small bubbles must be eliminated.
- I. Push the piston all the way in and then, without covering the bleed hole, pull the piston out very slowly so that oil continues to flow out of the bleed hole and air is not sucked into the unit. This is best accomplished by rotating the shaft back and forth while gently pulling on the piston.
- J. Replace the plug and bleed screw with the piston in the full out position.
- K. Replace the spring.
- L. Bench test the shock absorber.

To perform the dynamic test, refer to drawing SID-083 from the SID drawing package. The shock absorber should be dynamically tested whenever any fluid is visible or the SID is refurbished. It is not normally necessary every time the SID is calibrated.

## **1.0 DISASSEMBLY, INSPECTION AND ASSEMBLY....Continued**

### **1.8 Joint Adjustment Procedure**

#### **A. Hip Joints**

- (1) Remove the abdominal insert.
- (2) Insert a 3/8 inch allen wrench in the right hip plunger.
- (3) Adjust the hip plunger until the joint will support the weight of the stretched out leg assembly, one to two G setting (Figure 55). One to two G setting is the friction at the joint which will allow the assembly to be suspended and the assembly will move towards the earth when a small force is applied to the unsupported end of the assembly.
- (4) Repeat steps (2) and (3) on the left hip.
- (5) Replace the abdominal insert.
- (6) Insert a 5/16 inch allen wrench in right hip shoulder bolt.
- (7) Loosen the shoulder bolt.
- (8) Tighten the shoulder bolt until the joint will support the weight of the leg one-G setting rotated horizontally (Figure 56).
- (9) Repeat steps (6) through (8) on the left hip.

#### **B. Knee, Ankle and Foot Joints**

- (1) Insert a 3/16 inch allen wrench in the right knee bolt.
- (2) Tighten the knee bolt until the joint will support the weight of the leg, 1G to 2G setting (Figure 57).
- (3) Insert a 3/16 inch allen wrench in the right foot rotational bolt.
- (4) Tighten the bolt while rotating the foot, until the joint resistance can be detected (Figure 58).



## **1.0 DISASSEMBLY, INSPECTION AND ASSEMBLY....Continued**

- (5) Insert a 3/8 inch allen wrench in the right foot bolt.
- (6) Tighten the bolt until the joint will support the weight of the foot, one to two G setting (Figure 59).
- (7) Repeat setups (1) through (6) on left leg.

### **C. Knee Post Adjustments**

With the knee post removed from the leg prior to installation into the leg, tighten the 1/4-20 socket head cap screw to 5 to 6 foot-pounds with both centerlines of upper and lower knee posts aligned.

## **2.0 EXTERNAL DIMENSIONS AND WEIGHT**

### **2.1 Upright Seated Position for SID**

Remove outer chest skin flesh from the dummy.

Reference Figure 60. Place the SID on a flat, rigid, smooth, clean, dry, horizontal ( $\pm 0.5$  degrees) aluminum test surface which is at least 406 mm (16") wide and 406 mm (16") deep (A-P), so that the SID's midsagittal plane is vertical and centered on the test surface.

Adjust the SID's thorax so that the rear surface of the upper thoracic spine accelerometer ( $T_1$ ) mounting surface is resting against the vertical plane.

The SID's pelvis is adjusted so that the upper surface of the lumbar-pelvic adaptor is horizontal.

Adjust and secure the SID's head so that its occiput is 43 mm (1.7") forward of the transverse vertical plane with the vertical mating surface of the skull with its cover parallel to the transverse vertical plane.

The upper legs are positioned symmetrically about the midsagittal plane so that the distance between the knee pivot bolt heads is 292 mm  $\pm$  3 mm (11.5"  $\pm$  0.1").

## **2.0 EXTERNAL DIMENSIONS AND WEIGHT....Continued**

The lower legs are positioned in planes parallel to the midsagittal plane so that the lines between the midpoint of the knee pivots and the ankle pivots are vertical.

### **2.2 SID Configuration Verification Test**

Reference Figure 60.

Place the SID in the Upright Seated Position.

Measure the SID's seated height (SH) from the seating surface to the uppermost point on the head-skin surface.

Measure the SID's H-point locations (HP) from the seating surface to the center of the holes in the pelvis flesh covering in line with the hip motion ball.

Measure the knee pivot distance from the backline to the center of the knee pivot bolt head.

Measure the knee pivot distance (KV) from the center of the knee pivot bolt head to the bottom of the heel when the SID's foot is horizontal and pointing forward.

Measure from the seat surface to the top of rib number one at the centerline of the rib cage (RH). Adjust anti-sag device if rib is not at the specified height.

Measure from the backline surface to the top of rib number one at the centerline of the rib cage (RD).

Measure the SID's hip width at the widest point of the pelvic section (HW).

Measure the rib width from the centerline of the dummy to the outer edge of the rib wrap on the impacted side (RW). The difference between the top and bottom of the rib wrap should be no more than 3 mm (0.1").

### **2.3 SID Weight Verification Test**

The SID should weigh as specified in the table below. The definition of sub assemblies is indicated on the assembly drawing (SA-SID-M001A). Record the sub assembly weight.

**2.0 EXTERNAL DIMENSIONS AND WEIGHT....Continued**

COMPONENT	WEIGHT (kg)	WEIGHT (lbs)
Head	4.54 ± 0.05	10.0 ± 0.1
Neck	0.86 ± 0.05	1.9 ± 0.1
Upper Torso	29.6 ± 0.45	65.2 ± 1.0
Lower Torso	16.7 ± 0.45	36.9 ± 1.0
Left Leg Assembly	12.4 ± 0.18	27.4 ± 0.4
Right Leg Assembly	12.4 ± 0.18	27.4 ± 0.4
TOTAL SID WEIGHT	75.3 to 78	166 to 172

**3.0 SID DRAWING LIST**

COMPLETED ASSEMBLY SIDE IMPACT DUMMY SA-SID-M001A

HEAD AND NECK DRAWING LIST SA-SID-M010

DRAWING NUMBER	REVISION No./DATE	DRAWING TITLE	DRWG SIZE	NUMBER REQD.
292-1610	2/27/73	Skin & Skull Assembly	D	1
----	----	Screw, SHCS 1/4-20 x 1-3/8 Long	--	4
292-1605	3/13/73	Molded Neck	--	1
----	----	Screw, SHCS 1/4-20 x 5/8 Long	--	2
----	----	Screw, SHCS 1/4-20 x 7/8 Long	--	1
292-1614	3/13/73	Neck Bracket Assembly	D	1
SID-080		Deleted		

**3.0 SID DRAWING LIST....Continued**

## SHOULDER-THORAX DRAWING LIST SA-SID-M030

DRAWING NUMBER	REVISION No./DATE	DRAWING TITLE	DRWG SIZE	NUMBER REQD.
SID-004	F	Thoracic Assembly	D	1
SID-005	F	Adaptor Assy. Thorax to Lumbar	C	1
SID-006	D	Lumbar Adaptor	B	1
SID-007	B	Bottom Plate, Thorax Assembly	B	1
SID-008	B	Bottom Plate Locator	A	1
SID-009	C	T <sub>12</sub> Accelerometer Mount Platform	B	1
SID-010	D	Side Plate, Thorax Assembly	C	2
SID-011	C	Front Block, Thorax Assembly	B	1
SID-012	C	Back Block, Thorax Assembly	C	1
SID-013	C	Top Plate, Thorax Assembly	B	1
SID-014	A	T <sub>1</sub> Base Plate, Thorax Assembly	B	1
SID-015		Deleted		
SID-016		Deleted		
SID-017		Deleted		
SID-018	A	Rib Assembly	C	10
SID-019	E	Rib (Steel Portion)	C	10
SID-020	C	Center Sternum Bar	C	1
SID-021	D	Sternum Plate (Urethane)	C	1
SID-022	D	Top & Bottom Sternum Bar	B	2
SID-023	B	Sternum Ballast	B	2
SID-024	H	Rib Bar	D	2

**3.0 SID DRAWING LIST....Continued**

DRAWING NUMBER	REVISION No./DATE	DRAWING TITLE	DRWG SIZE	NUMBER REQD.
SID-025	D	Rib Ballast - Front	B	2
SID-026	D	Rib Ballast - Rear	B	2
SID-027	D	Rib Bar Ballast - Right Side	C	1
SID-028	D	Rib Bar Ballast - Left Side	C	1
SID-029	C	Rib Ballast Cushion	A	20
SID-030	B	Rib Reinforcement	B	10
SID-031	C	Upr & Lwr Washer Bar, Sternum	C	2
SID-032	E	Rib Cage Support Angle	C	1
SID-033	E	Rib Attaching Hinge	C	1
SID-034	D	Hinge Mounting Block	C	1
SID-035	F	Bar, Rib Cage to Hinge	C	2
SID-036	E	T <sub>1</sub> Accelerometer Plate	B	1
SID-037	E	T <sub>1</sub> Accelerometer Mount	C	1
SID-038	D	T <sub>12</sub> Accelerometer Mount	B	1
SID-039	E	T <sub>12</sub> Accelerometer Cover	B	1
SID-040	B	Rib Wrap Assembly	C	1
SID-041	D	Outer Rib Pad	B	1
SID-042	C	Inner Rib Pad	C	2
SID-043	B	Washer Strip, Rib Pad	B	4
SID-044	D	Urethane Rib Wrap	D	1
SID-045	C	Anti-Bottom Pad	C	1
SID-046		Deleted		

**3.0 SID DRAWING LIST....Continued**

DRAWING NUMBER	REVISION No./DATE	DRAWING TITLE	DRWG SIZE	NUMBER REQD.
SID-047		Deleted		
SID-048		Deleted		
SID-049		Deleted		
SID-050	C	Middle Shoulder Foam	C	1
SID-051	- -	Upper Shoulder Foam	D	1
SID-052	B	Lower Shoulder Foam	C	1
SID-053	I	General Rib Cage Layout	E	1
SID-054	B	Gate Damper	C	1
SID-055	B	Pivot Pin Damper	C	1
SID-056	E	Frame, Shock Absorber Mount	C	1
SID-057	D	Support Angle	C	1
SID-058	C	Washers	C	1
SID-059	B	Bracket & Rings (Optional)	C	1
SID-060		Deleted		
SID-061	D	Shaft & Spacer, Shock to Rib Bar	C	1
SID-062	E	Clevis, Shock Absorber to Rib Bar	C	1
SID-063	D	Shoulder Plate	C	1
SID-064	C	Rib Cage Support Details	C	1
SID-065	B	Skin-Zipper Assembly	C	1
SID-066	C	Outer Skin	C	1
SID-067	A	Zipper Assembly Front	B	1
SID-068	A	Zipper Assembly Rear	B	1

**3.0 SID DRAWING LIST....Continued**

DRAWING NUMBER	REVISION No./DATE	DRAWING TITLE	DRWG SIZE	NUMBER REQD.
SID-069	C	Arm Foam	C	2
SID-070	F	Bolt Listing - Tapered Socket Head	B	
SID-071	F	Bolt Listing - Socket Head	B	
SID-072	E	Bolt Listing - Flat Head Socket	B	
SID-073	C	Bolt Listing - Machine Screw	B	
SID-074	D	Hex Nut Listing	B	
SID-075	H	Washer Listing	B	
SID-076		Deleted		
SID-077	B	Rod End Shock	C	
SID-083	--	Thoracic Shock Test Proc/Specs	B	
SID-084	A	Rib Ballast Nut Plate	B	4
SID-085	A	Rib Bar Cushion	A	10
SID-089	A	Linear Potentiometer (Optional)	B	1

**LUMBAR SPINE DRAWING LIST SA-SID-M050**

DRAWING NUMBER	REVISION No./DATE	DRAWING TITLE	DRWG SIZE	NUMBER REQD.
SID-002	B	Lumbar (Molded)	C	1
SID-003	A	Flange, Lumbar	B	1
SID-088	A	Lumbar Pelvic Adaptor	C	1
ATD-7101	B	Cable Assembly - Lumbar	B	1
----	----	Screw, SHCS 1/4-20 x 2.0 Long	--	3
----	----	Hex Nut 1/2-20	--	1
----	----	Screw, SHCS 1/4-20 x 3/4 Long	--	2

**3.0 SID DRAWING LIST....Continued**

## PELVIS AND ABDOMEN DRAWING LIST SA-SID-M060

DRAWING NUMBER	REVISION No./DATE	DRAWING TITLE	DRWG SIZE	NUMBER REQD.
SID-087-1 SID-087-2	G	Pelvis Structure & Flesh Assembly (Drwg Shts 1 & 2)	D	1
ATD-7122	A	Femur Friction Plunger	B	2
ATD-3250-2	G	Abdominal Insert	C	1
SID-090	--	SID Pelvic Accel. Mount	A	1
ATD-3232-1	I	Left Femur Assembly	C	1
ATD-3232-2	I	Right Femur Assembly	C	1
ATD-7148		Deleted		
----	--	Screw, SHCS 10-32 x 3/8 Long	--	4
----	--	Screw/SHCS 1/4-20x3/4 Long Nylok	--	6
SID-081		Deleted		
SID-082		Deleted		
SID-086		Deleted		

## LEG ASSEMBLY RIGHT SA-SID-M080

DRAWING NUMBER	REVISIO N No./DATE	DRAWING TITLE	DRWG SIZE	NUMBER REQD.
SID-078	B	Knee Post Upper	C	1
SID-079	B	Knee Post Lower	C	1
ATD-7131-2	A	Upper Leg Bone	C	1
ATD-3800-2	--	Thigh Flesh	C	1



**3.0 SID DRAWING LIST....Continued**

DRAWING NUMBER	REVISION No./DATE	DRAWING TITLE	DRWG SIZE	NUMBER REQD.
ATD-3801-2	A	Knee Flesh	C	1
ATD-3738-2	G	Lower Leg Assembly	D	1
ATD-3199-2	- -	Ankle Rotation Assembly	B	1
ATD-3141-2	- -	Foot Assembly	B	1
ATD-3773	C	Torque Adjusting Screw	A	1
ATD-3770-2	C	Washer	A	1
ATD-3766	B	Bushing	A	1
ATD-3774-2	D	Knee Joint Assembly	C	1
		Screw, SHCS 1/2-20 x 2.0 Long		1
		Screw, SHCS 3/8 Dia x 1.0 Long		1
		Screw, SHCS 3/8-16 x 2.0 Long		1
		Screw, SHCS 3/8-16 x 1-3/4 Long		1
		Screw, SHCS 5/16-24 x 7/8 Long		1
		E-Last-O Spring No. ES-3511 Vlier Engineering Corp.		1
		Screw, SHCS 1/4-28 x 1 1/2 Long		1
		Disc-Spring-Schnorp, 20mm ODx10.2mm IDx0.9mm THK		3

**3.0 SID DRAWING LIST....Continued**

DRAWING NUMBER	REVISION No./DATE	DRAWING TITLE	DRWG SIZE	NUMBER REQD.
		Thrust Bearing 3B5-5 Winfred M. Berg Inc.		1
		Heavy Spring Lock Washer 1/4 ID x 0.077 THK		1
		5/16 ID Spring Lock Washer		1
		Screw, SHCS #6-32 x 1/2 Long		1

**LEG ASSEMBLY LEFT SA-SID-M081**

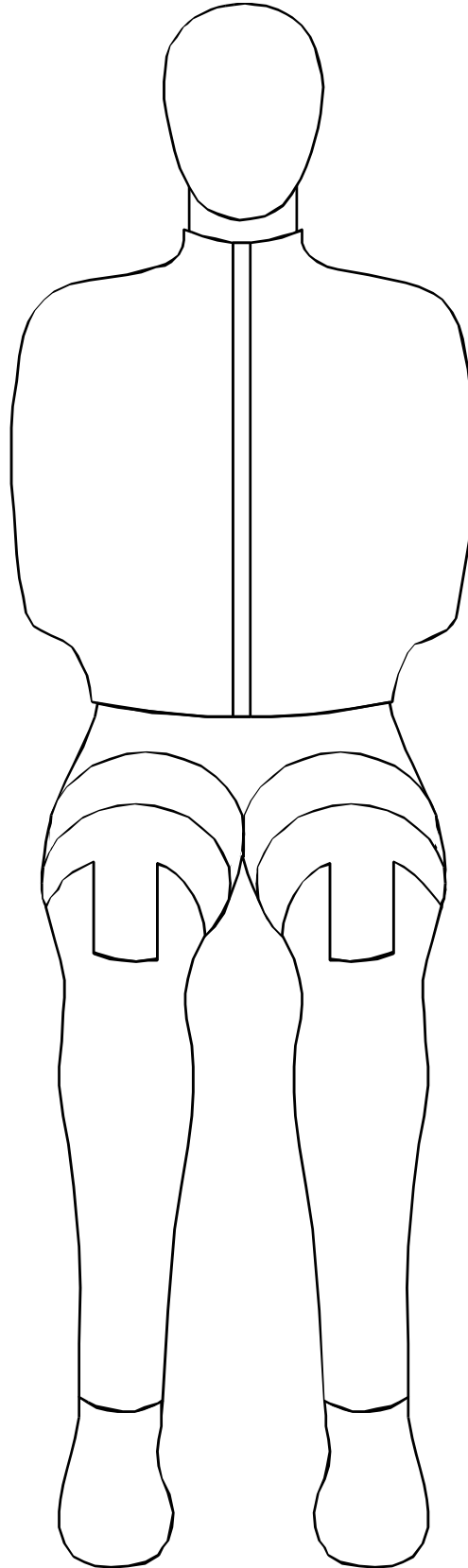
DRAWING NUMBER	REVISION No./DATE	DRAWING TITLE	DRWG SIZE	NUMBER REQD.
SID-078	B	Knee Post Upper	C	1
SID-079	B	Knee Post Lower	C	1
ATD-7131-2	A	Upper Leg Bone	C	1
ATD-3800-1	--	Thigh Flesh	C	1
ATD-3801-1	A	Knee Flesh	C	1
ATD-3738-1	G	Lower Leg Assembly	D	1
ATD-3199-1	--	Ankle Rotation Assembly	B	1
ATD-3141-1	--	Foot Assembly	B	1
ATD-3773	C	Torque Adjusting Screw	A	1
ATD-3770-1	C	Washer	A	1
ATD-3766	B	Bushing	A	1
ATD-3774-1	D	Knee Joint Assembly	C	1
		Screw, SHCS 1/2-20 x 2.0 Lg		1

**3.0 SID DRAWING LIST....Continued**

DRAWING NUMBER	REVISION No./DATE	DRAWING TITLE	DRWG SIZE	NUMBER REQD.
		Screw, SHCS 3/8 Dia x 1.0 Lg		1
		Screw, SHCS 3/8-16 x 2.0 Lg		1
		Screw, SHCS 3/8-16 x 1-3/4 Lg		1
		Screw, SHCS 5/16-24 x 7/8 Lg		1
		E-Last-O Spring No. ES-3511 Vlier Engineering Corp.		1
		Screw, SHCS 1/4-28 x 1/2 Lg		1
		Disc-Spring-Schnorp, 20mm Odx10.2mm Idx0.9mm THK		3
		Thrust Bearing 3B5-5 Winfred M. Berg Inc.		1
		Heavy Spring Lock Washer 1/4 ID x 0.077 THK		1
		5/16 ID Spring Lock Washer		1
		Screw, SHCS #6-32 x 1/2 Long		1

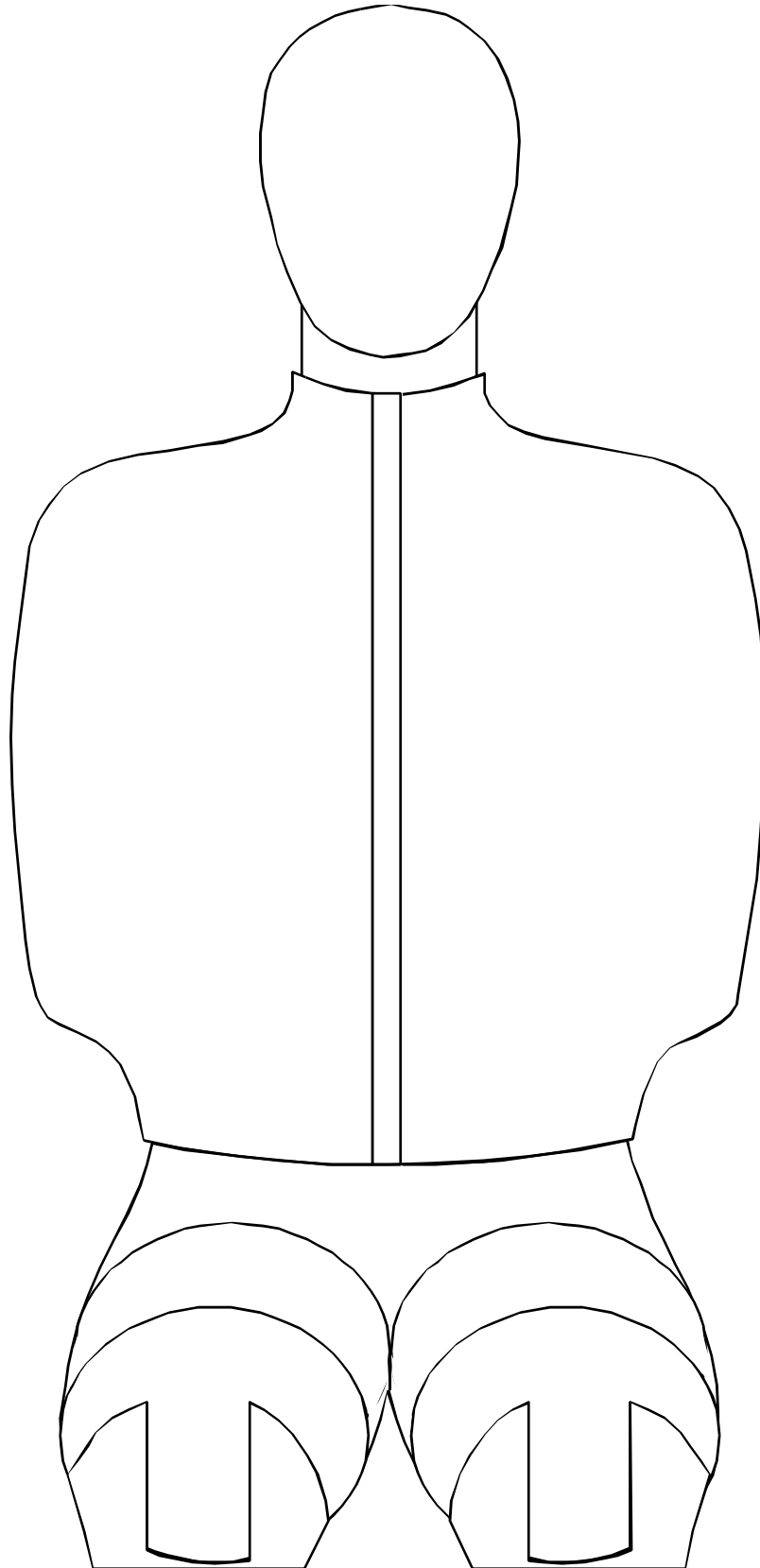
**4.0 FIGURES**

FIGURE 1  
SID FRONT VIEW



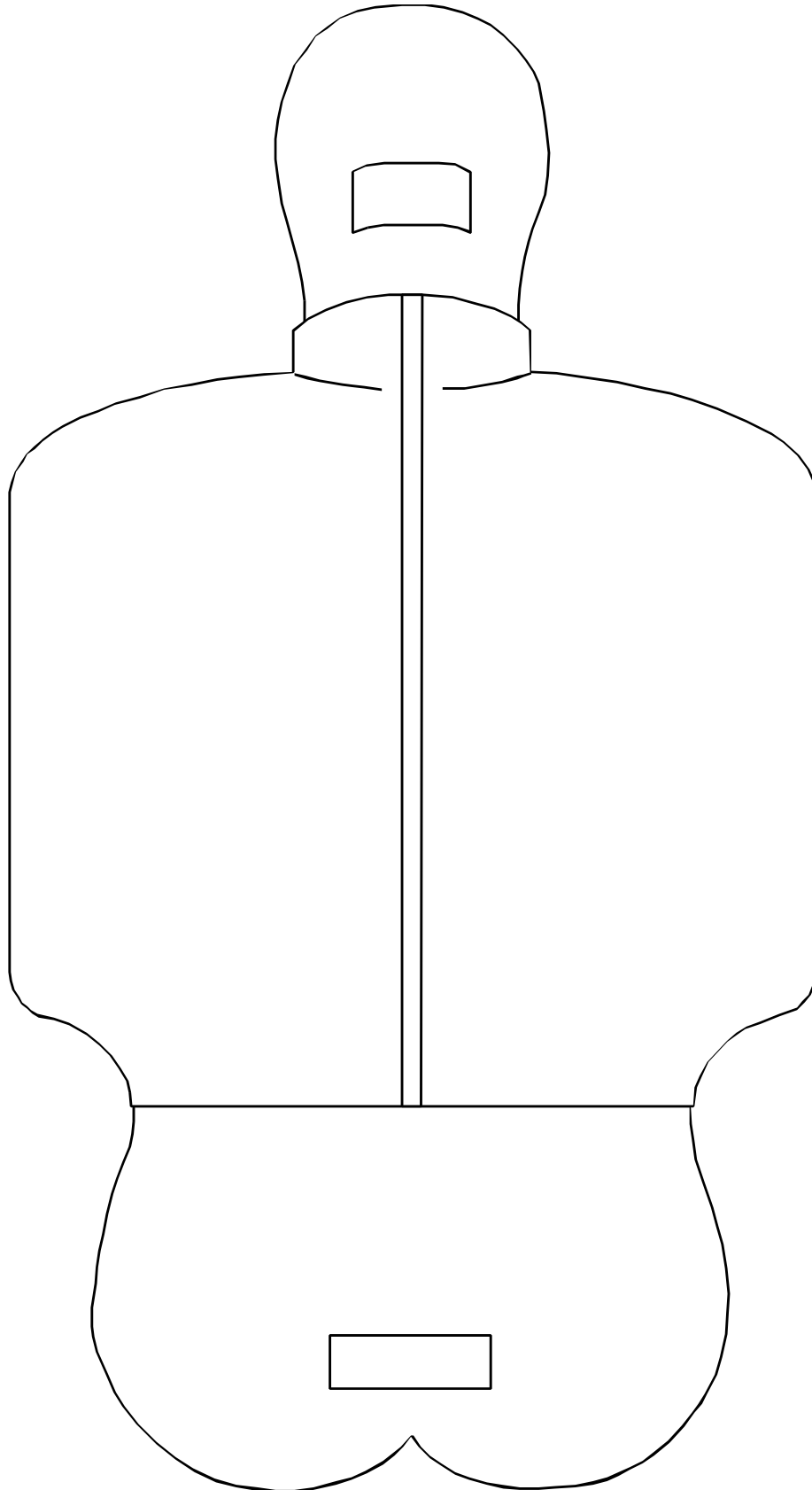
**4.0 FIGURES....Continued**

FIGURE 2  
SID UPPER TORSO



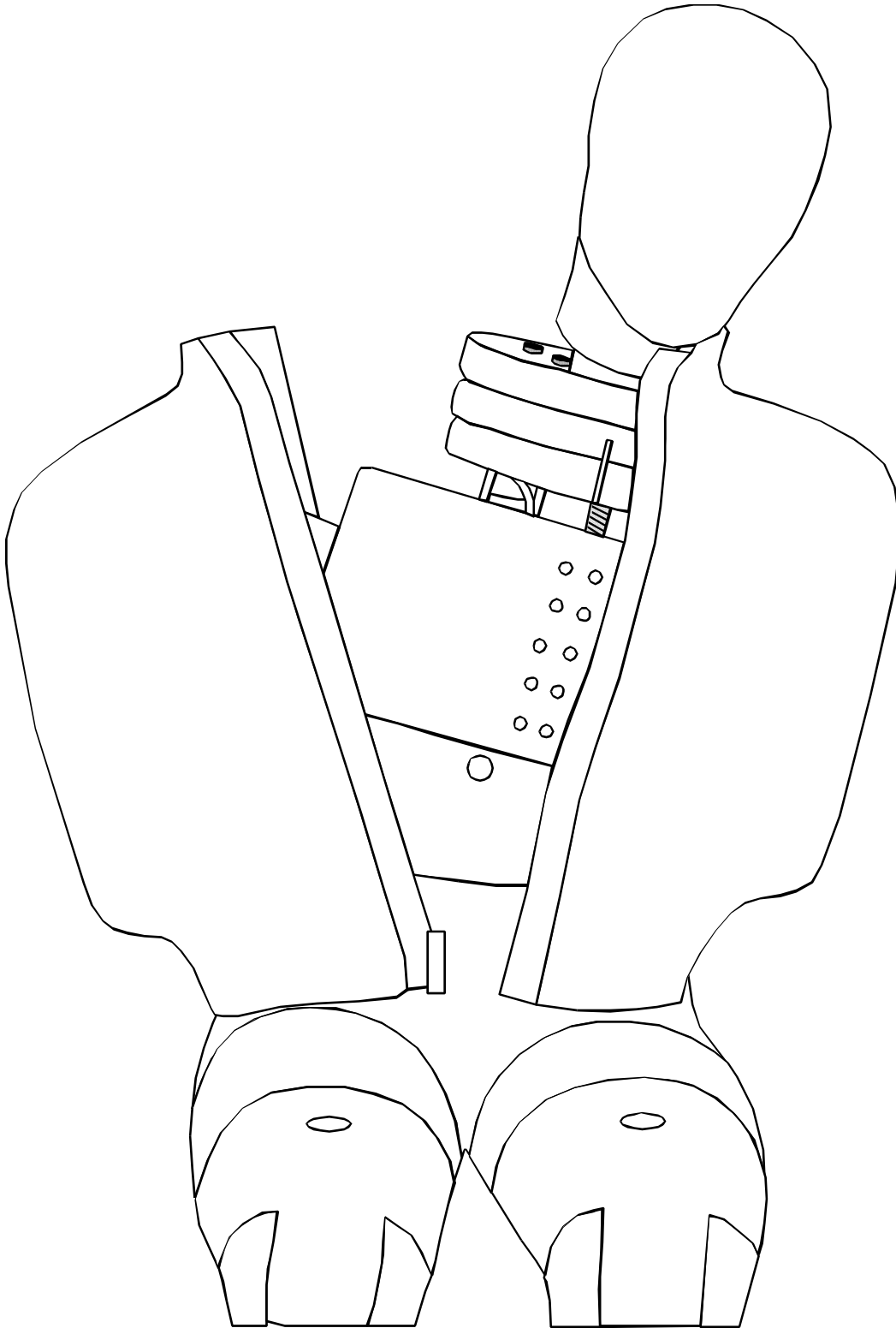
**4.0 FIGURES....Continued**

FIGURE 3  
SID REAR VIEW



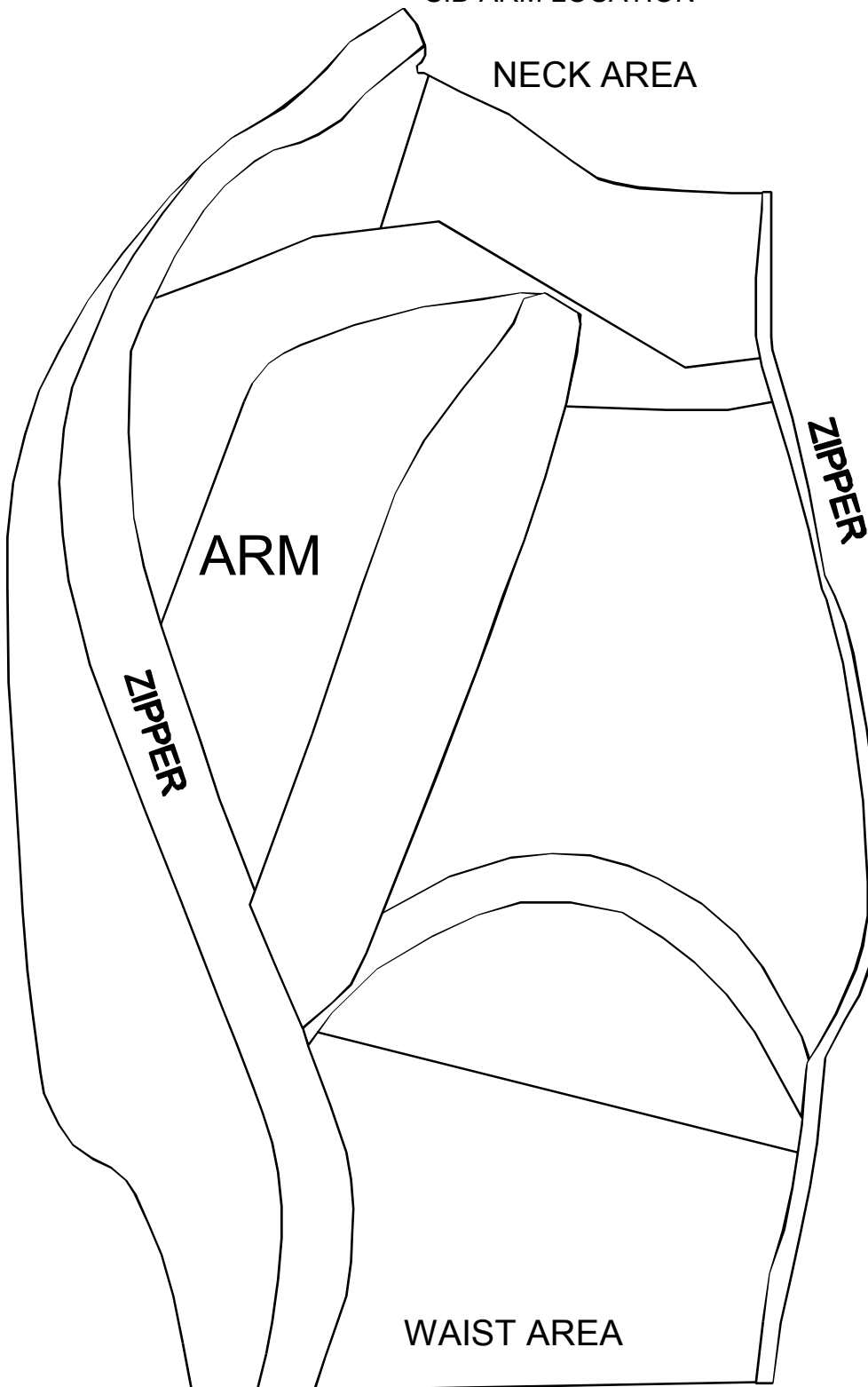
**4.0 FIGURES....Continued**

FIGURE 4  
SID FRONT INTERNAL VIEW



**4.0 FIGURES....Continued**

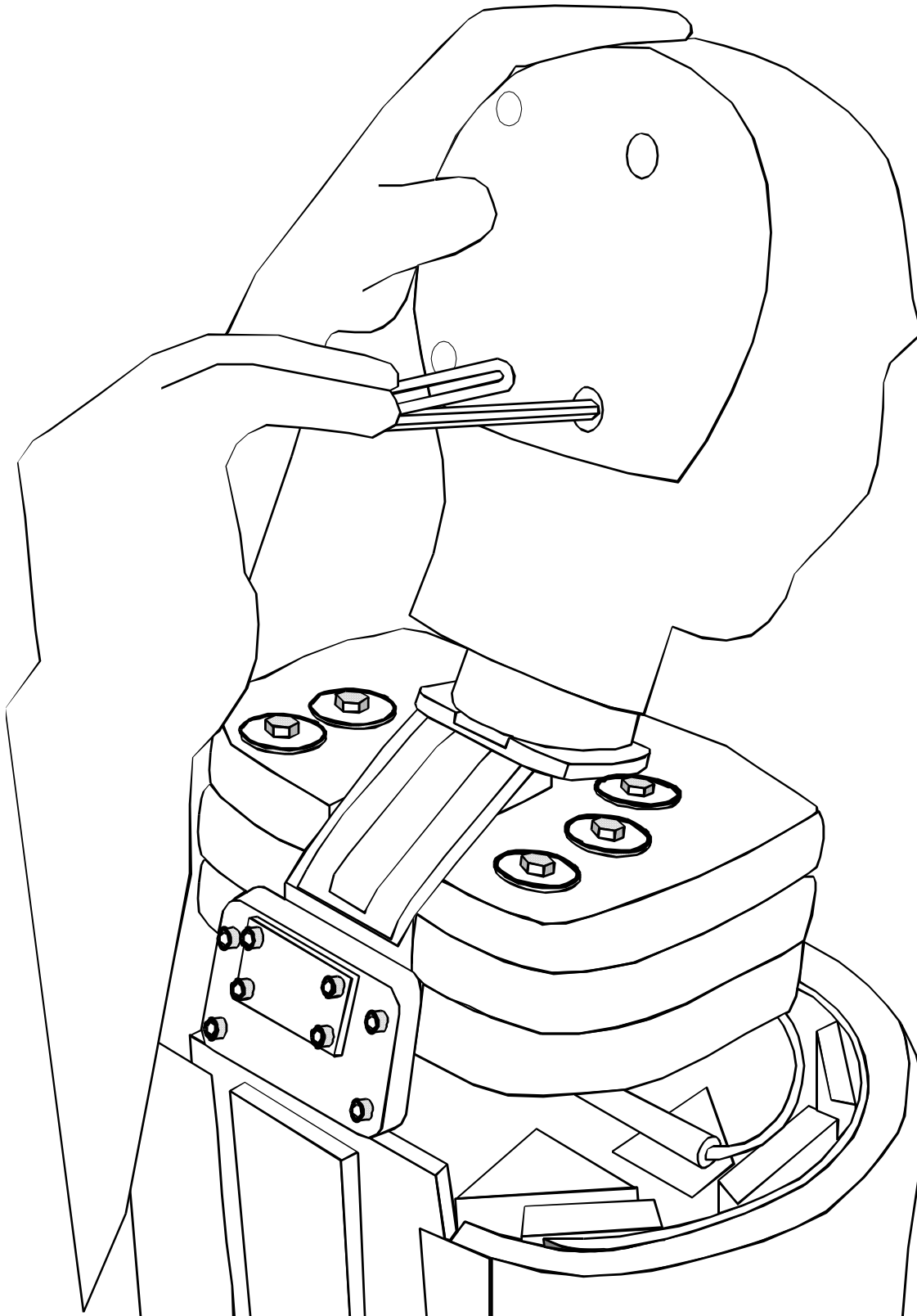
FIGURE 5  
SID ARM LOCATION





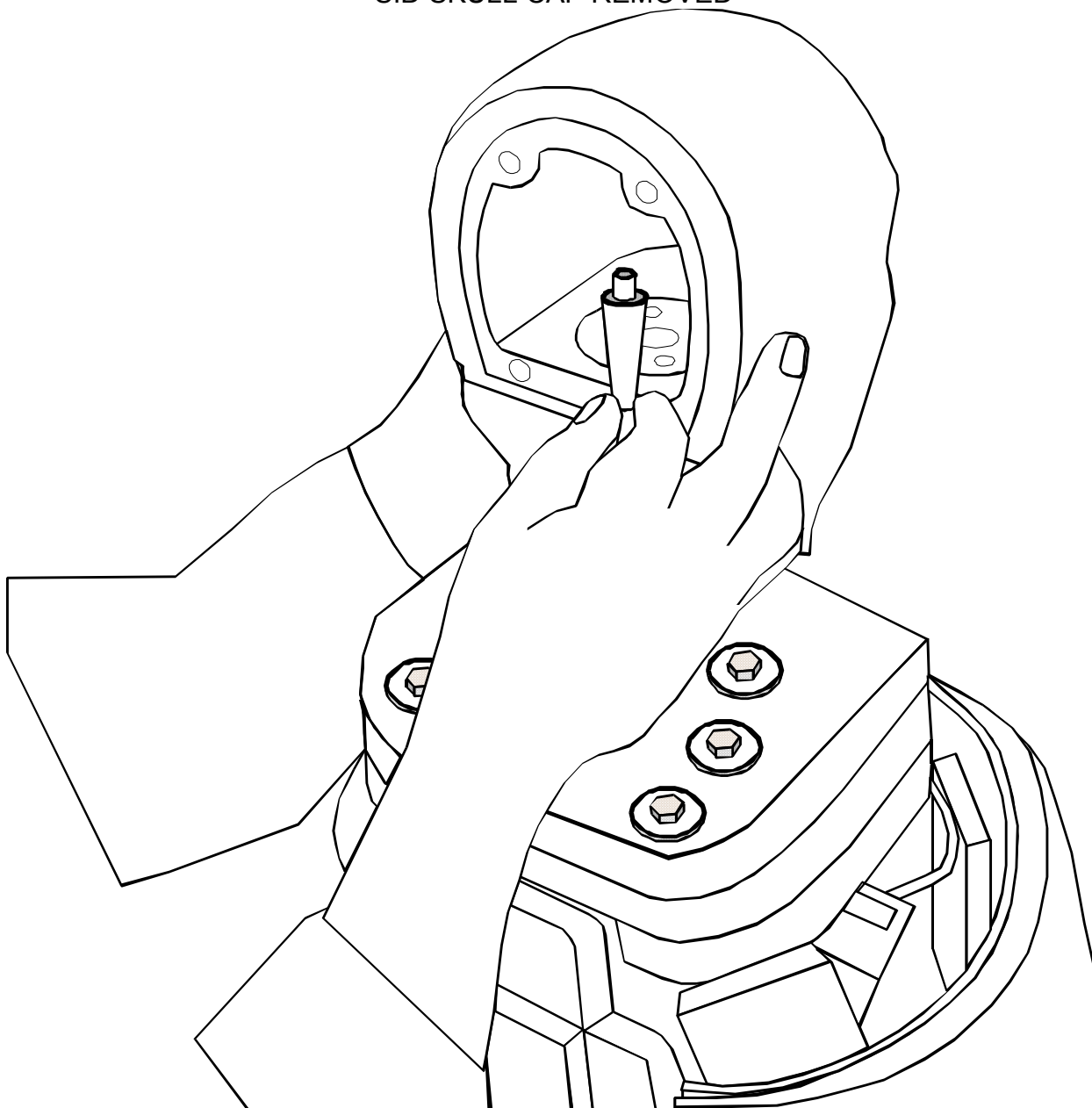
**4.0 FIGURES....Continued**

FIGURE 6  
SID SKULL CAP REMOVAL



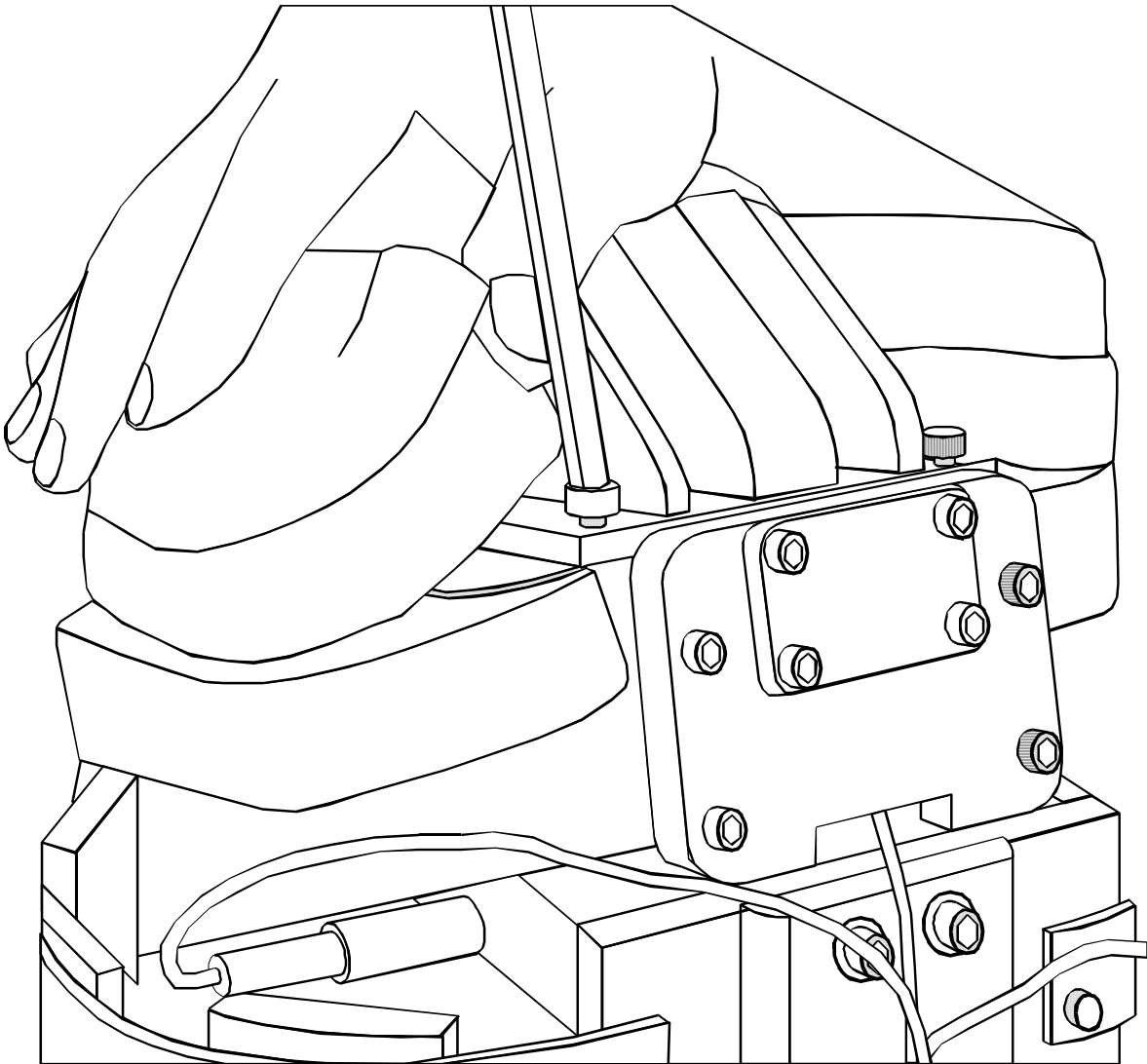
**4.0 FIGURES....Continued**

FIGURE 7  
SID SKULL CAP REMOVED



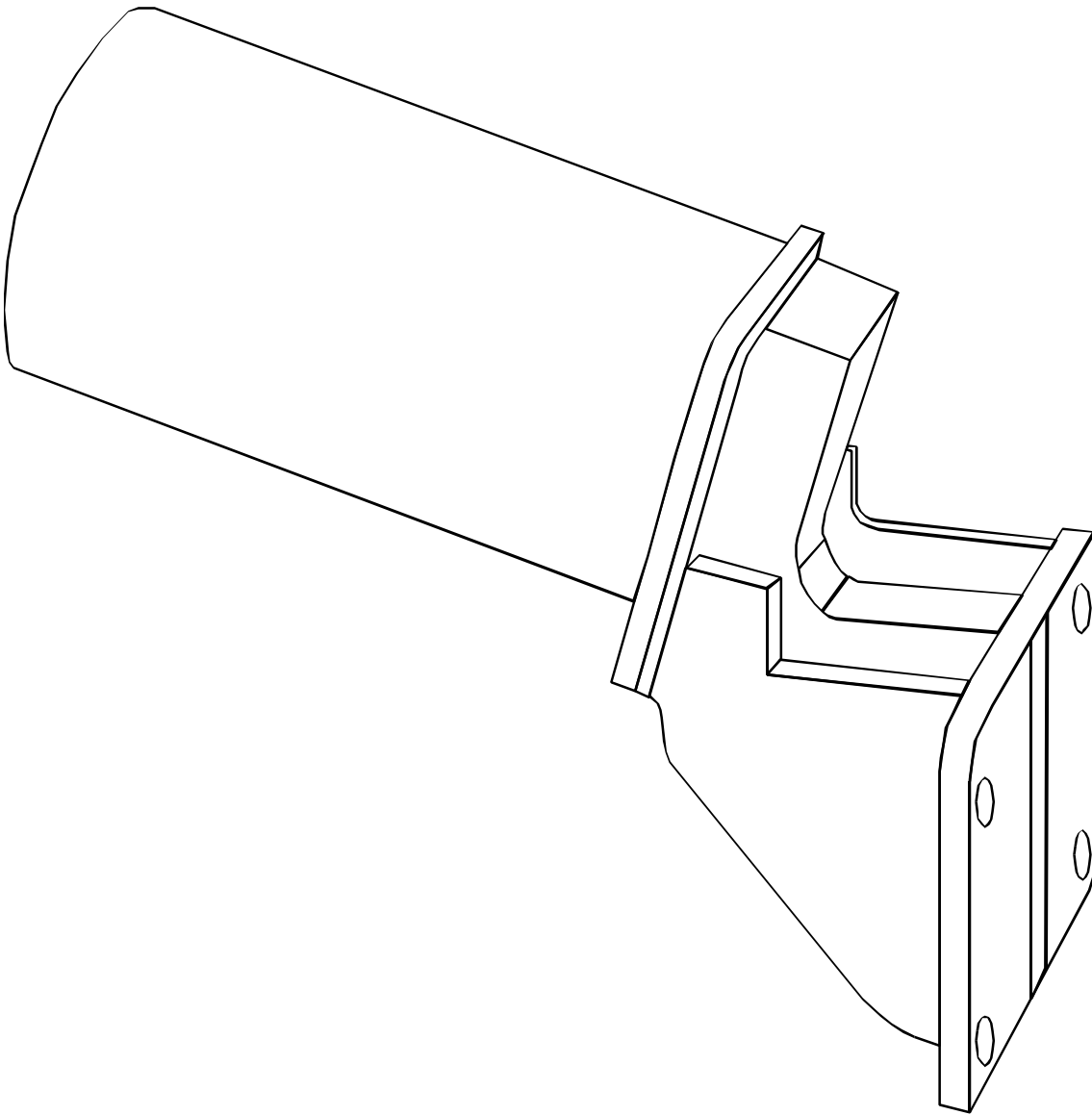
**4.0 FIGURES....Continued**

FIGURE 8  
NECK BRACKET REMOVAL



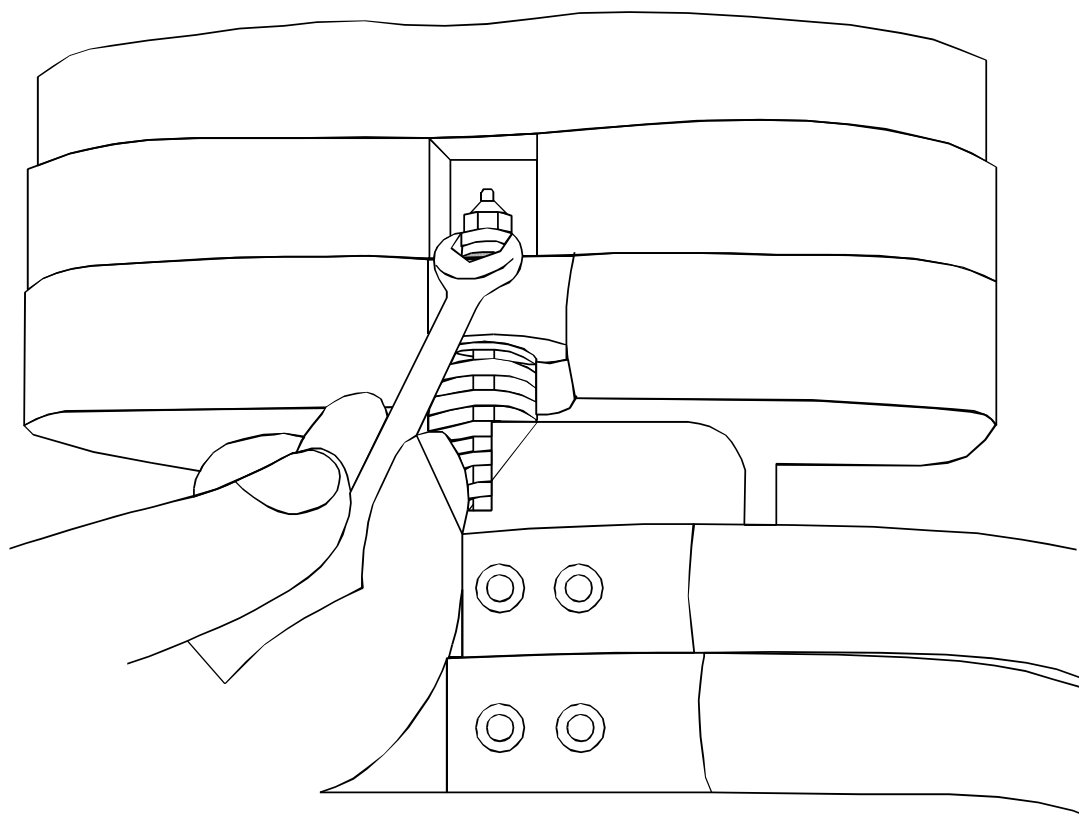
**4.0 FIGURES....Continued**

FIGURE 9  
NECK AND NECK BRACKET ASSEMBLY



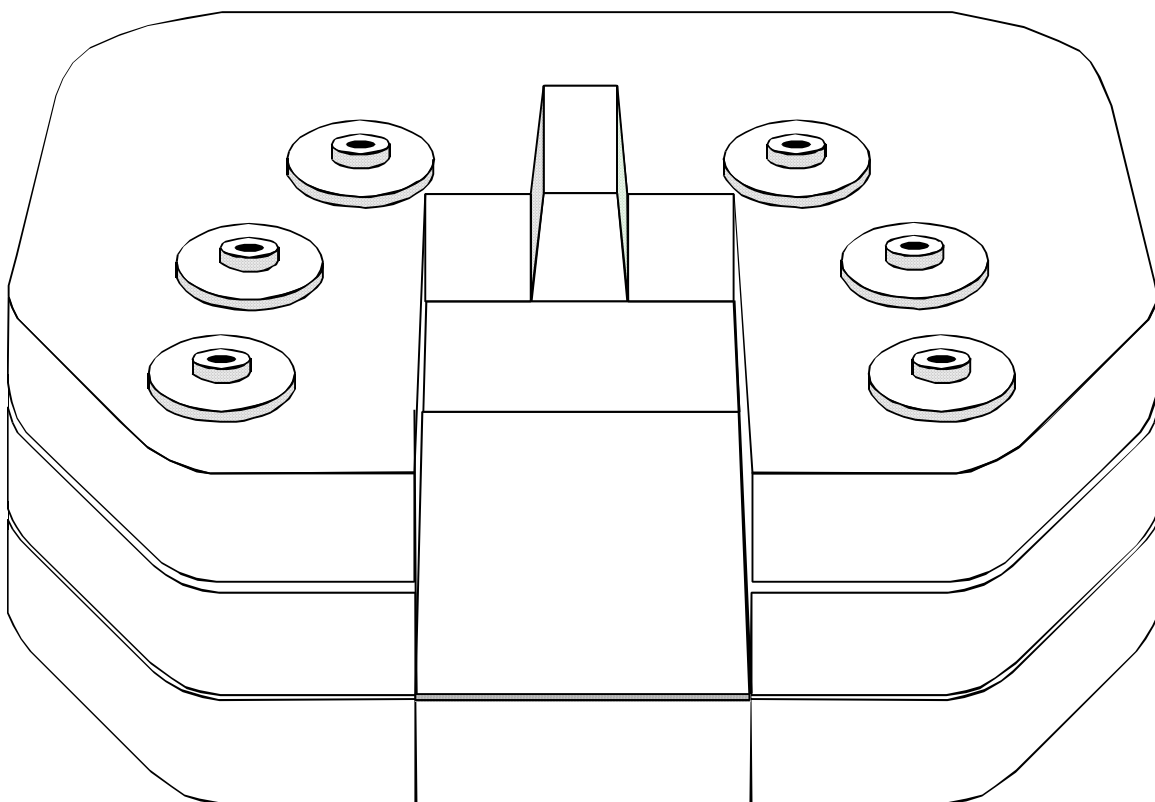
**4.0 FIGURES....Continued**

FIGURE 10  
ANTI-SAG DEVICE SEPARATION FROM SHOULDER PLATE



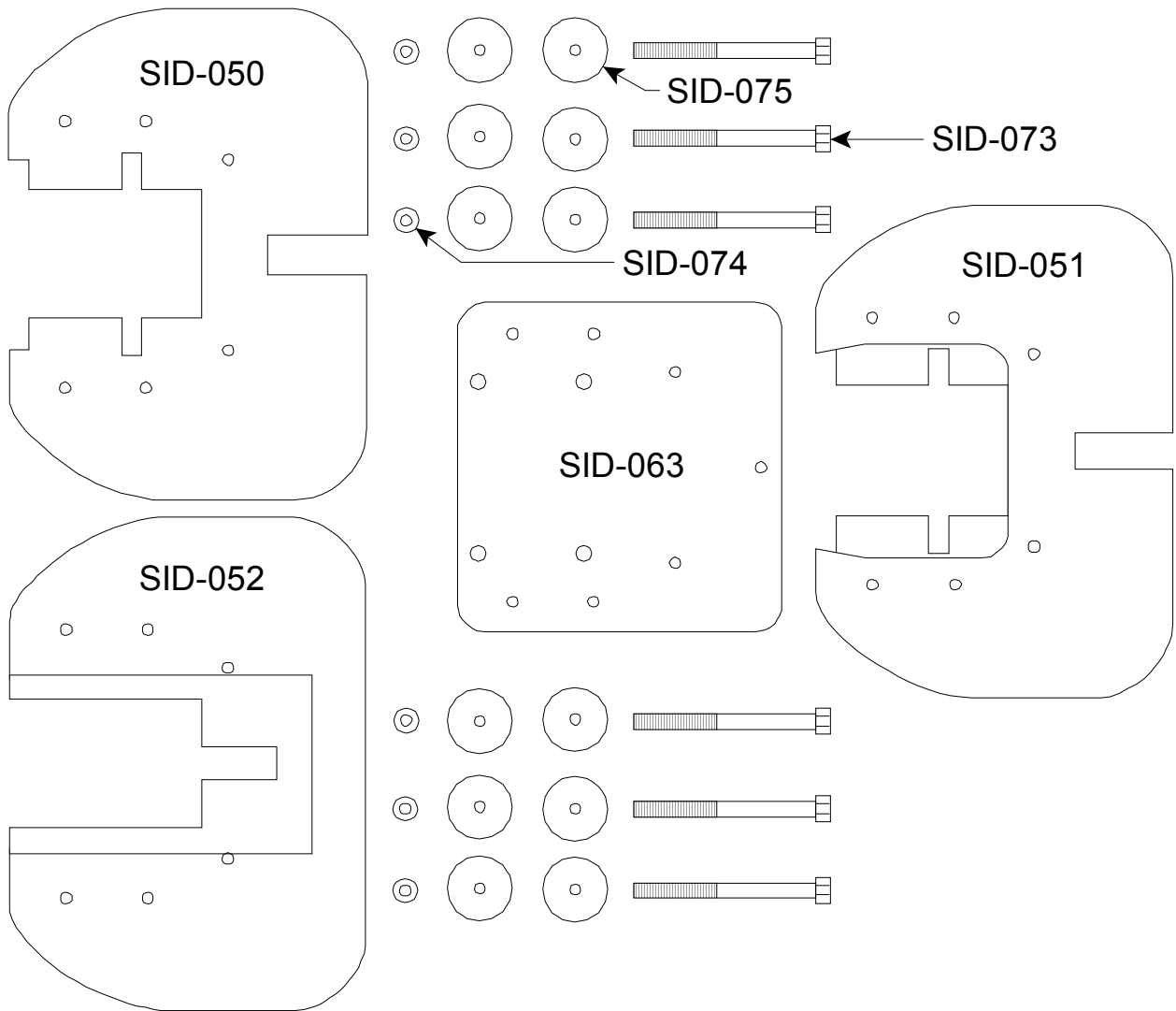
**4.0 FIGURES....Continued**

FIGURE 11  
SHOULDER PLATE ASSEMBLY, SID-063



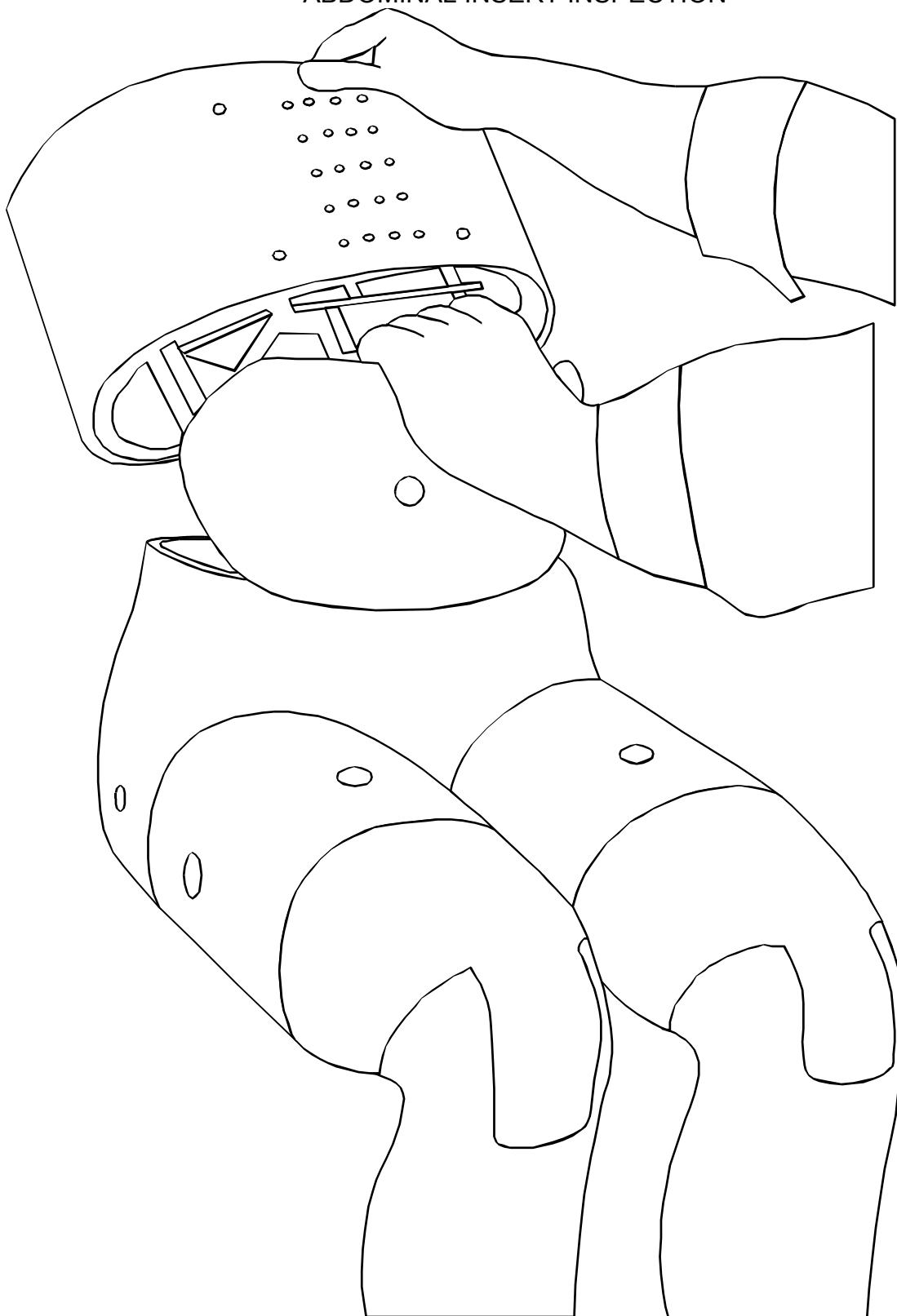
4.0 FIGURES....Continued

FIGURE 12  
SHOULDER PLATE ASSEMBLY COMPONENTS



**4.0 FIGURES....Continued**

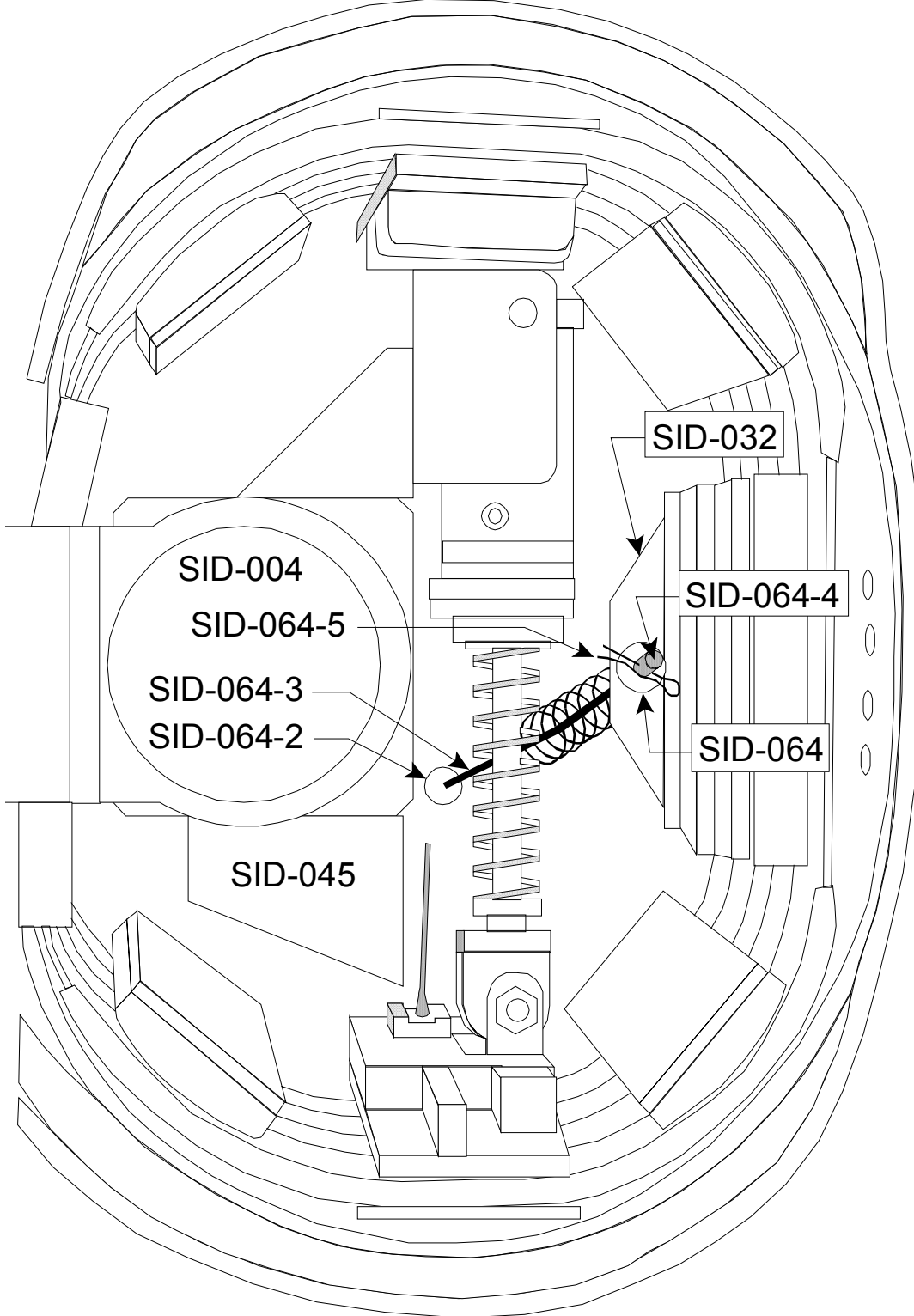
FIGURE 13  
ABDOMINAL INSERT INSPECTION





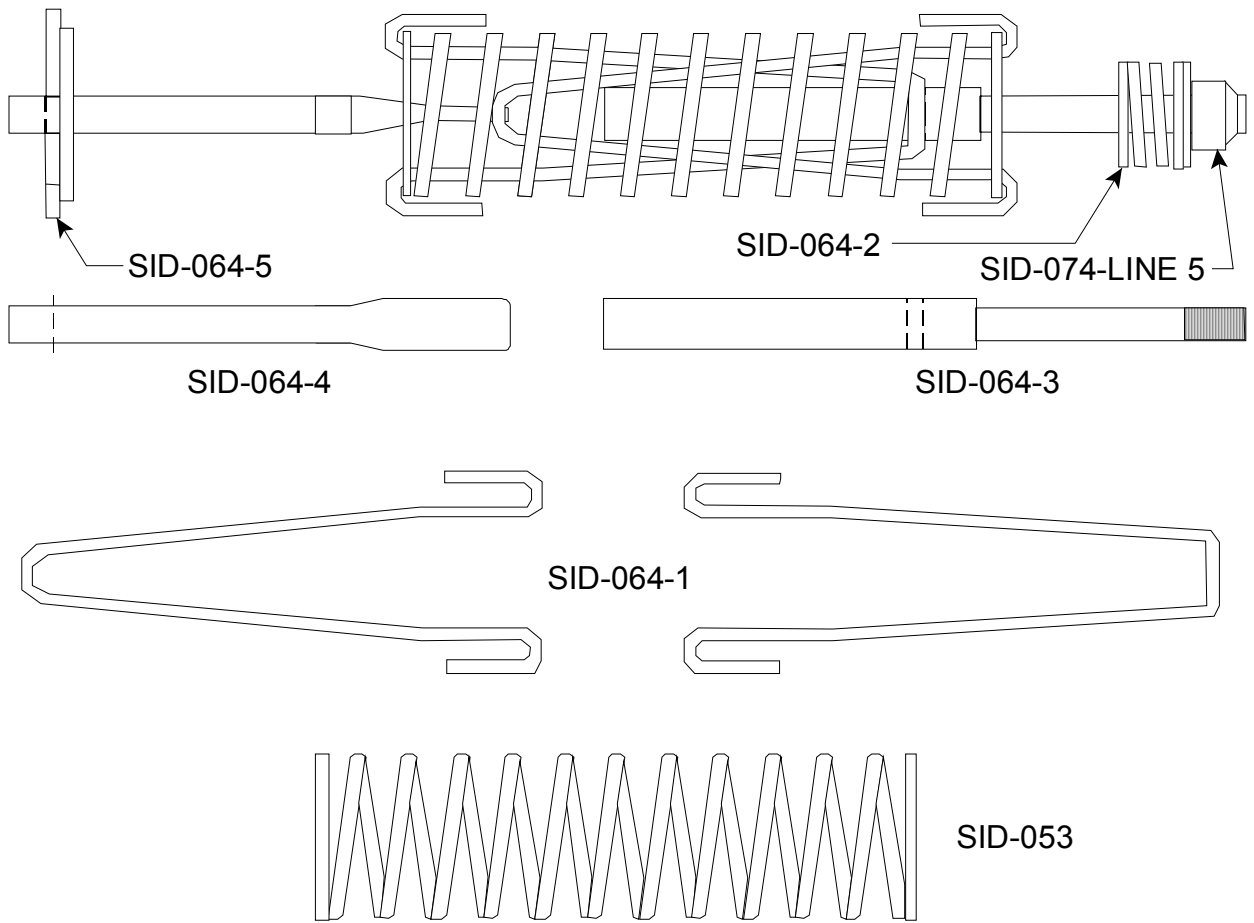
**4.0 FIGURES....Continued**

FIGURE 14  
ANTI-SAG DEVICE, SID-053

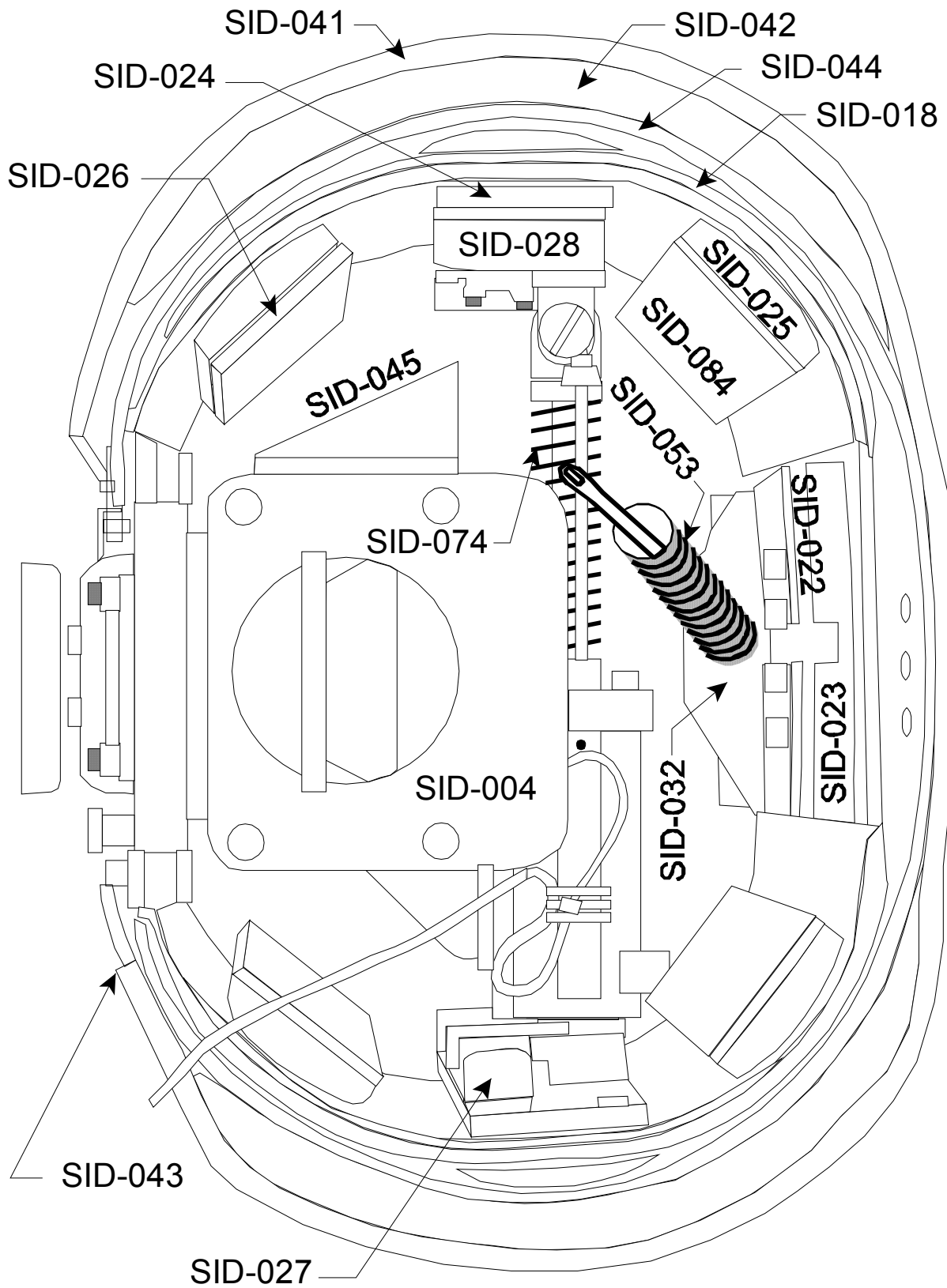


4.0 FIGURES....Continued

FIGURE 15  
ANTI-SAG DEVICE COMPONENTS

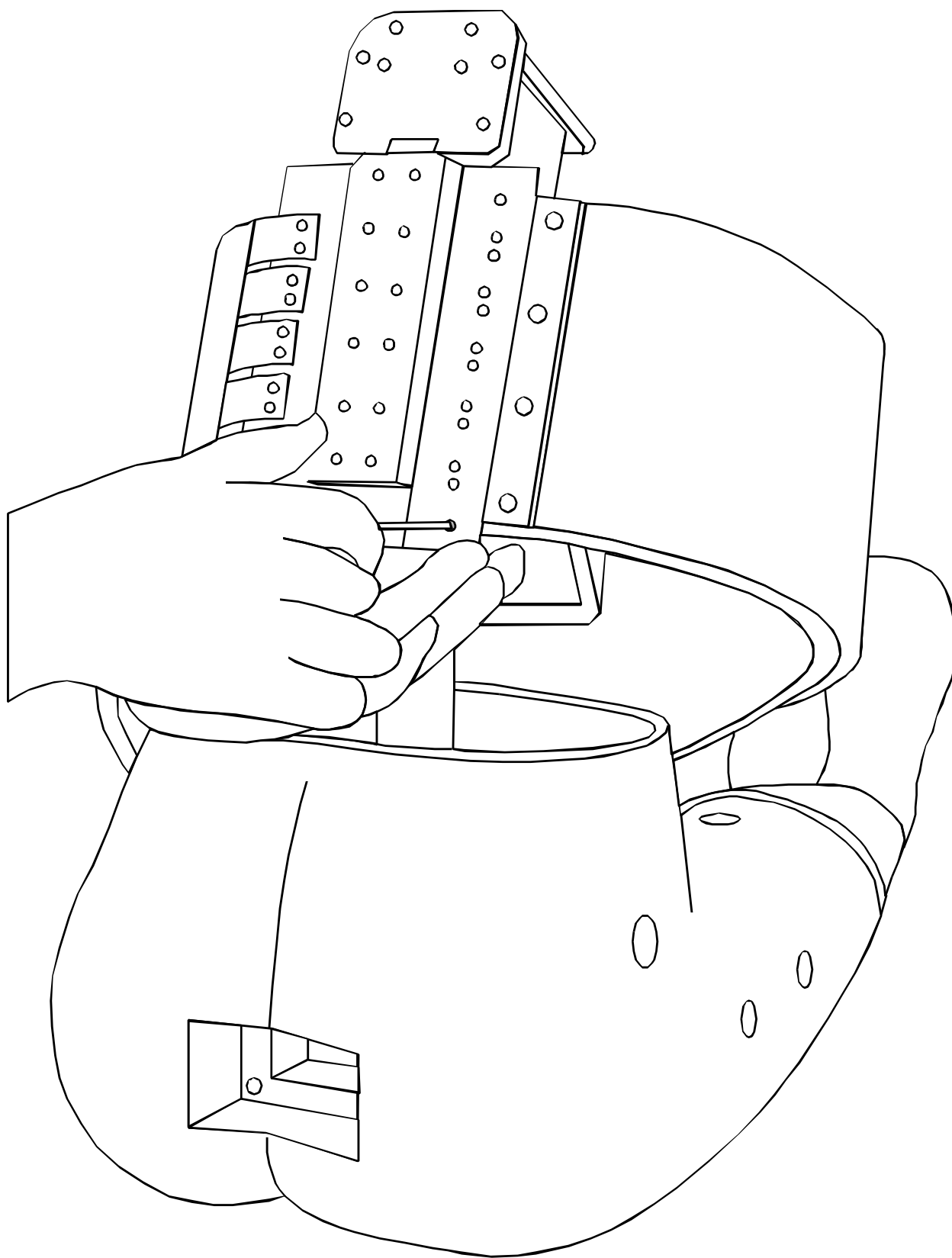


## 4.0 FIGURES....Continued

FIGURE 16  
RIB WRAP ASSEMBLY, SID-040

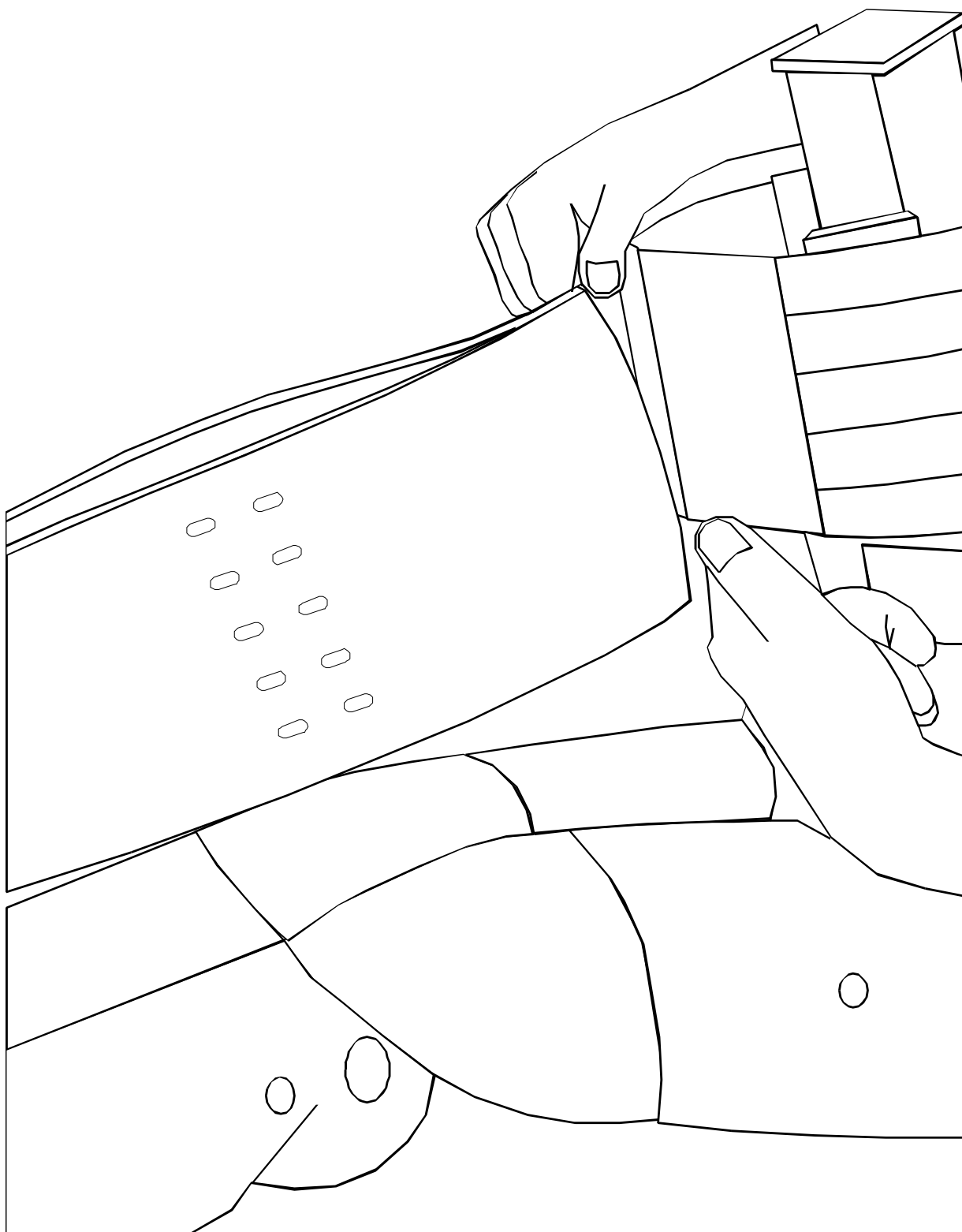
**4.0 FIGURES....Continued**

FIGURE 17  
RIB WRAP REMOVAL FROM THORAX



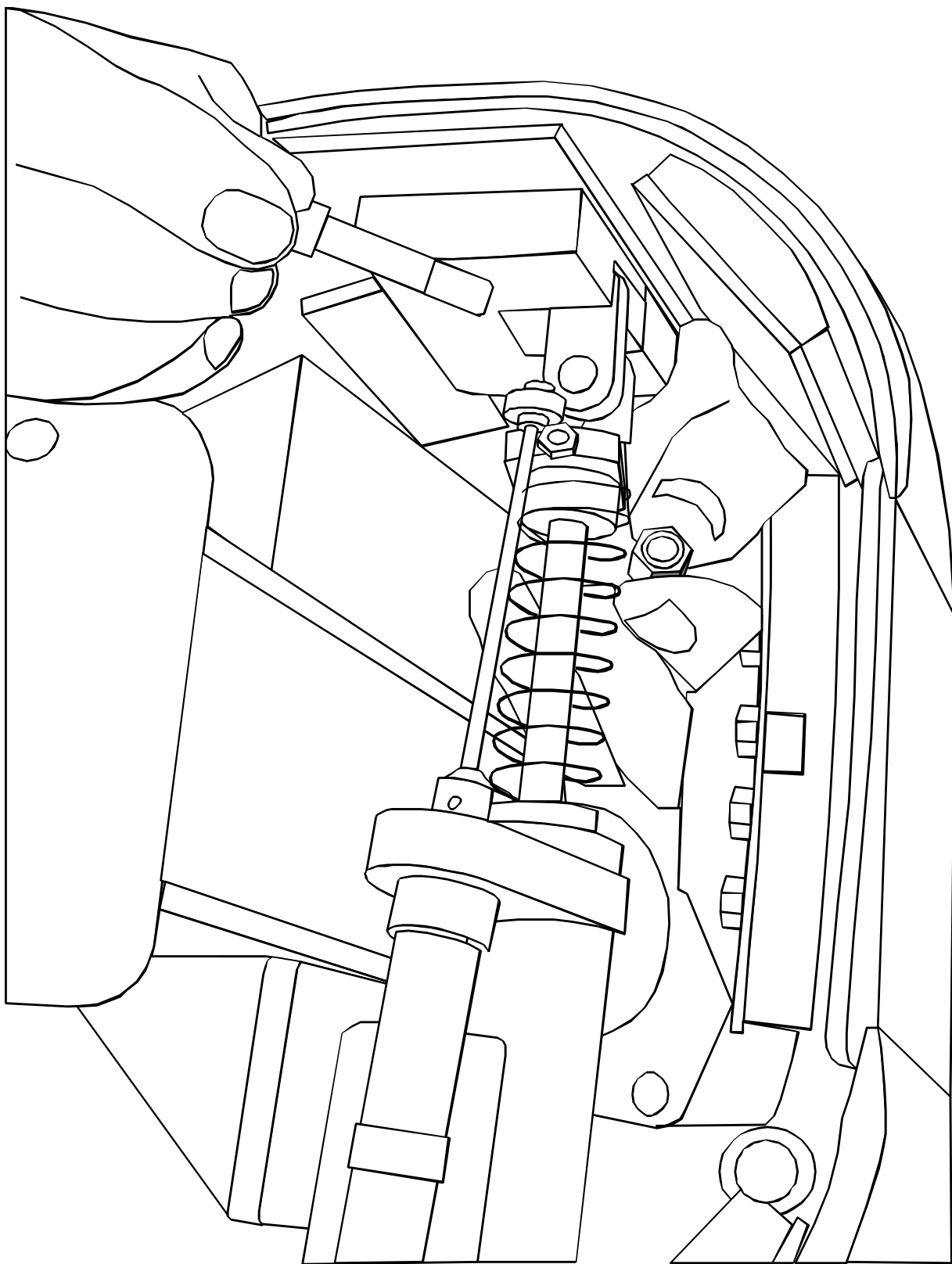
**4.0 FIGURES....Continued**

FIGURE 18  
RIB WRAP REMOVAL FROM RIB CAGE



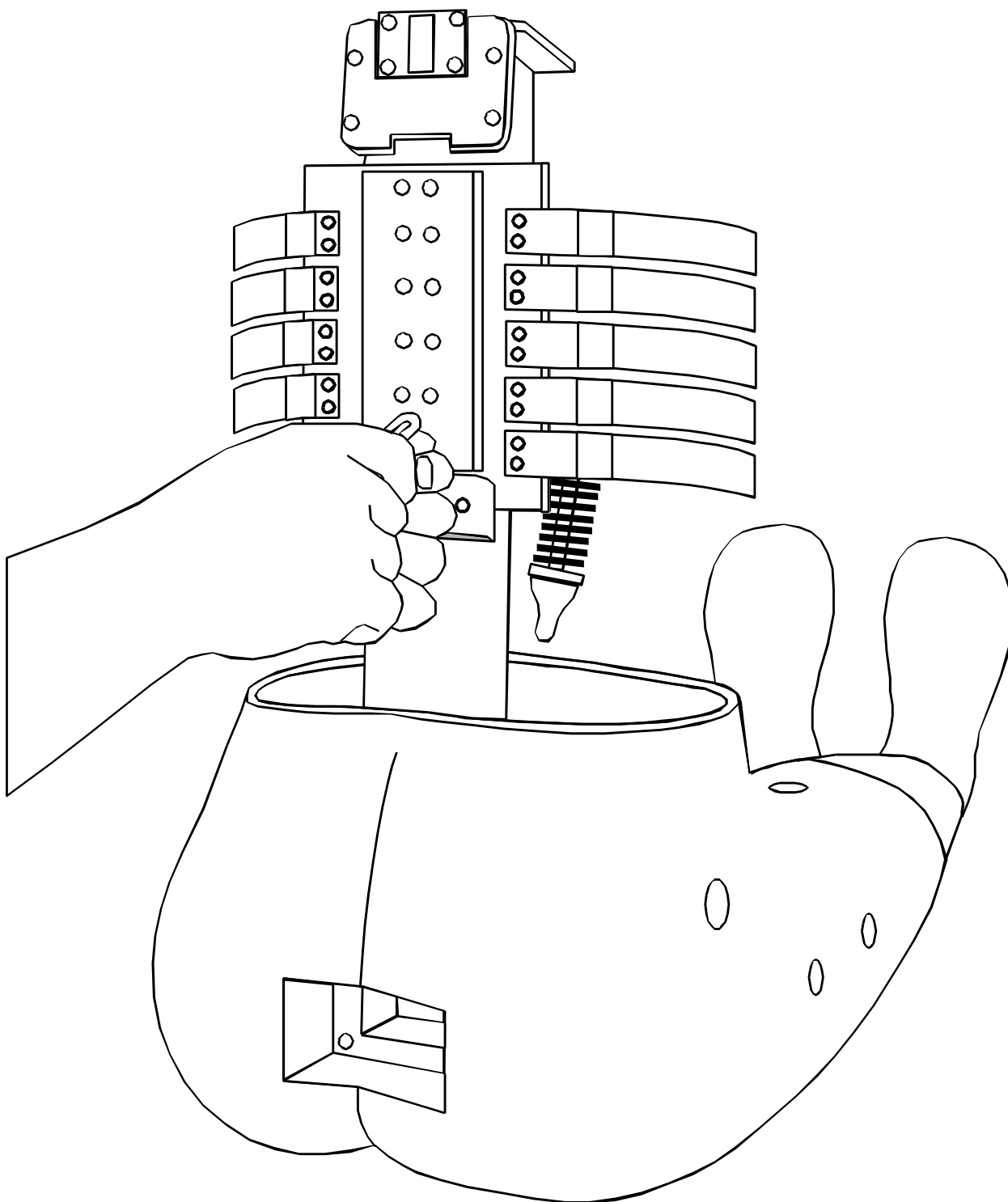
**4.0 FIGURES....Continued**

FIGURE 19  
RIB DISASSEMBLY



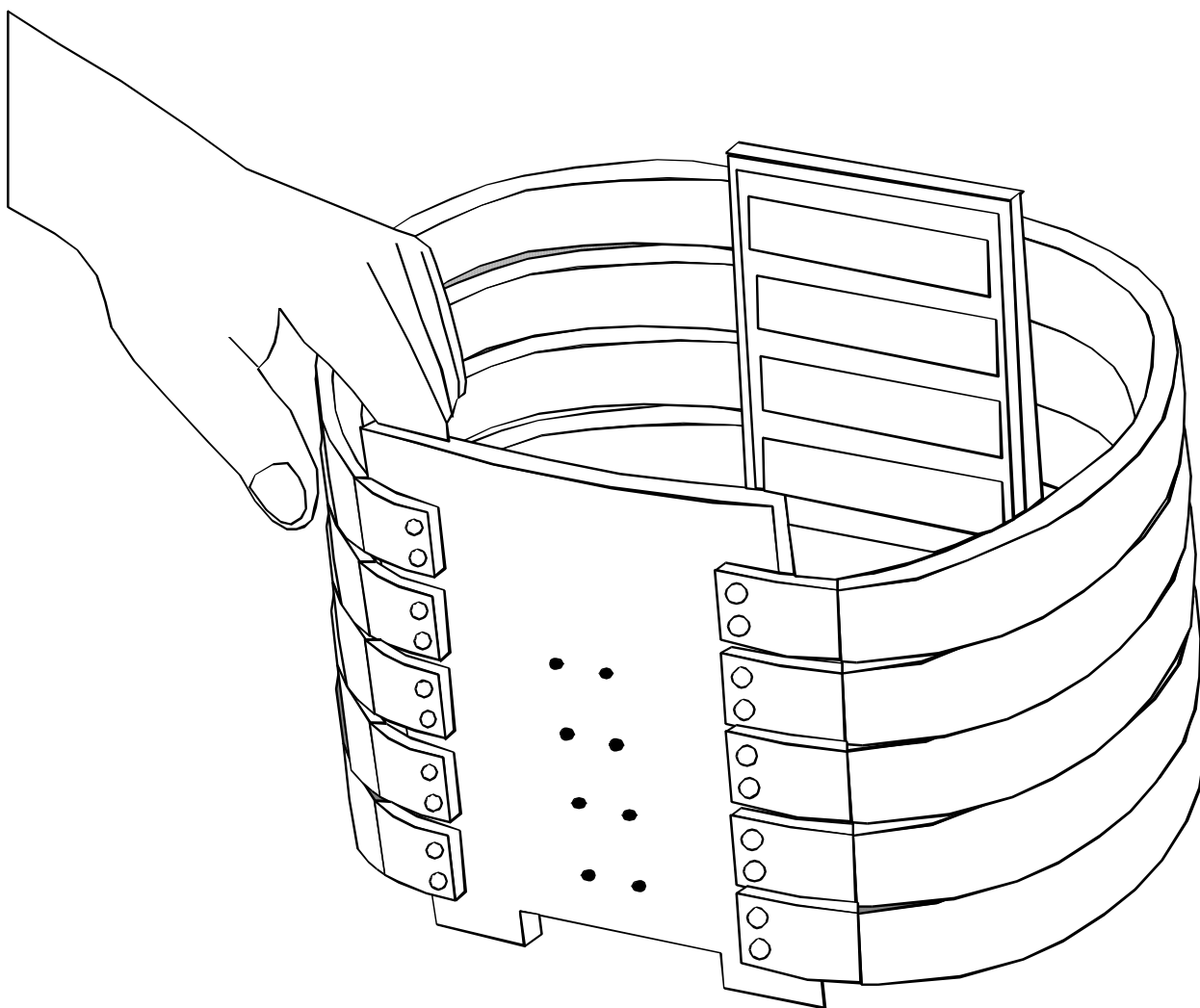
**4.0 FIGURES....Continued**

FIGURE 20  
HINGE MOUNTING BLOCK REMOVAL FROM THORACIC SPINE BOX



**4.0 FIGURES....Continued**

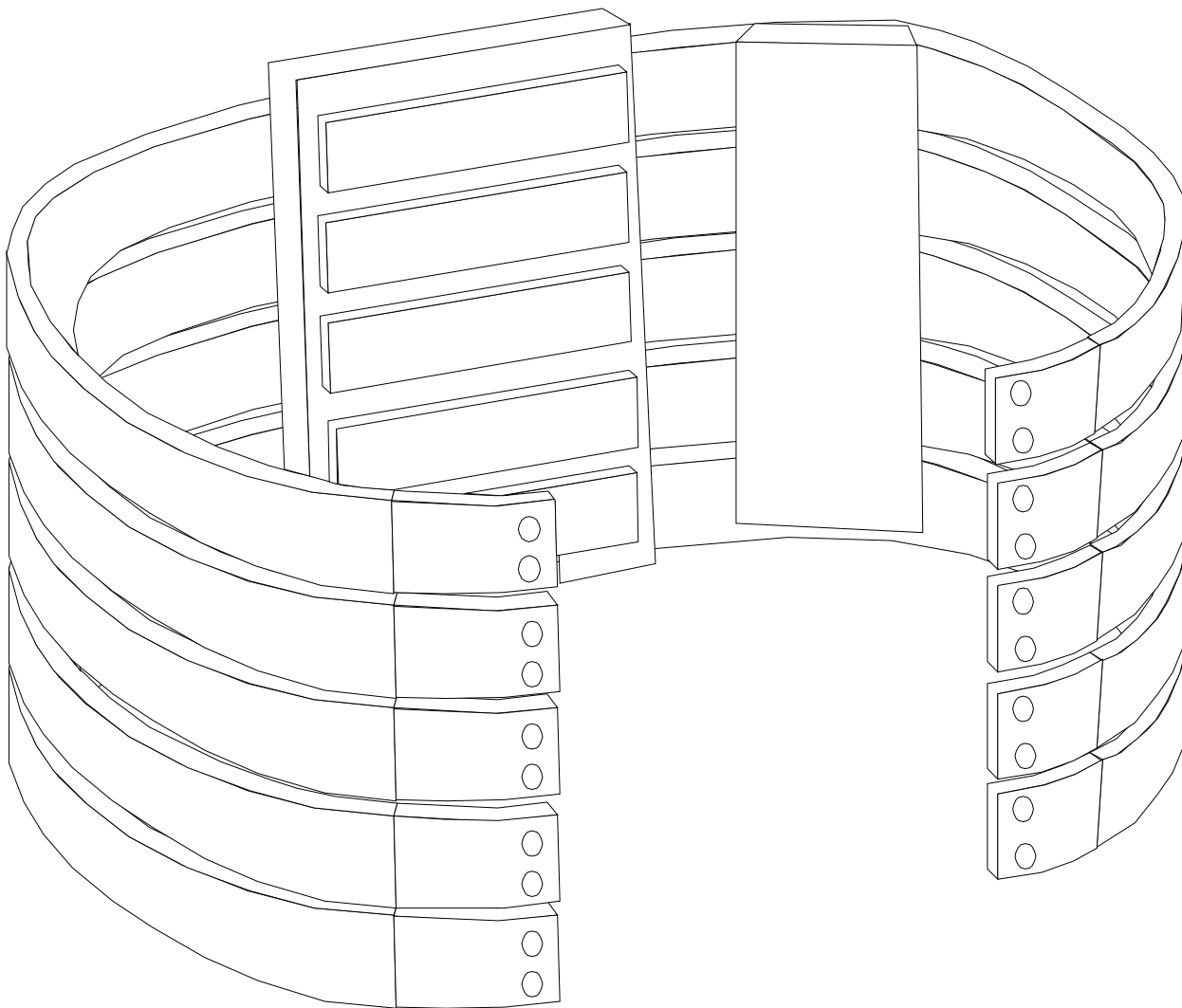
FIGURE 21  
SEPARATION OF HINGE FROM RIBS





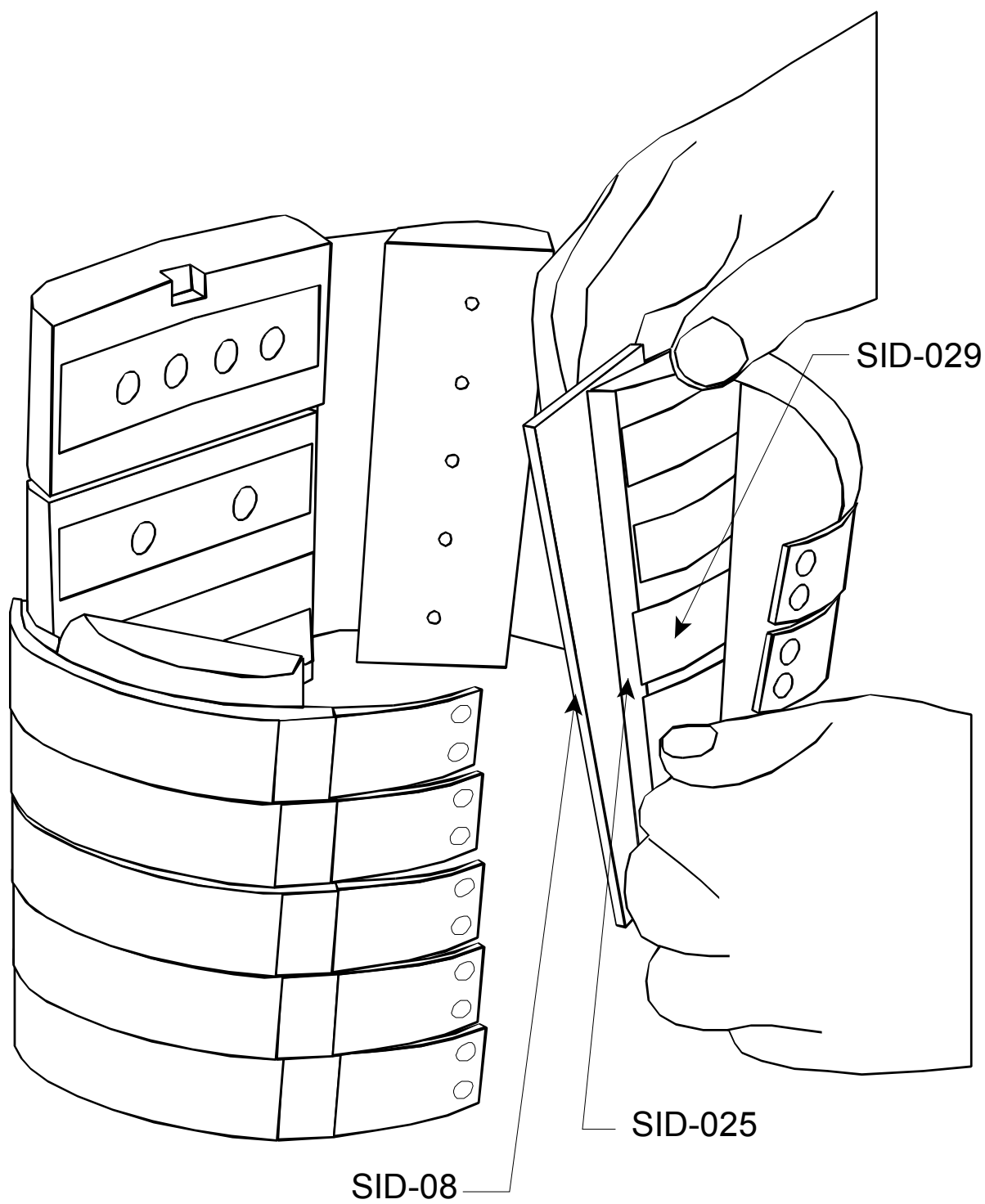
**4.0 FIGURES....Continued**

FIGURE 22  
RIB BALLAST REMOVAL



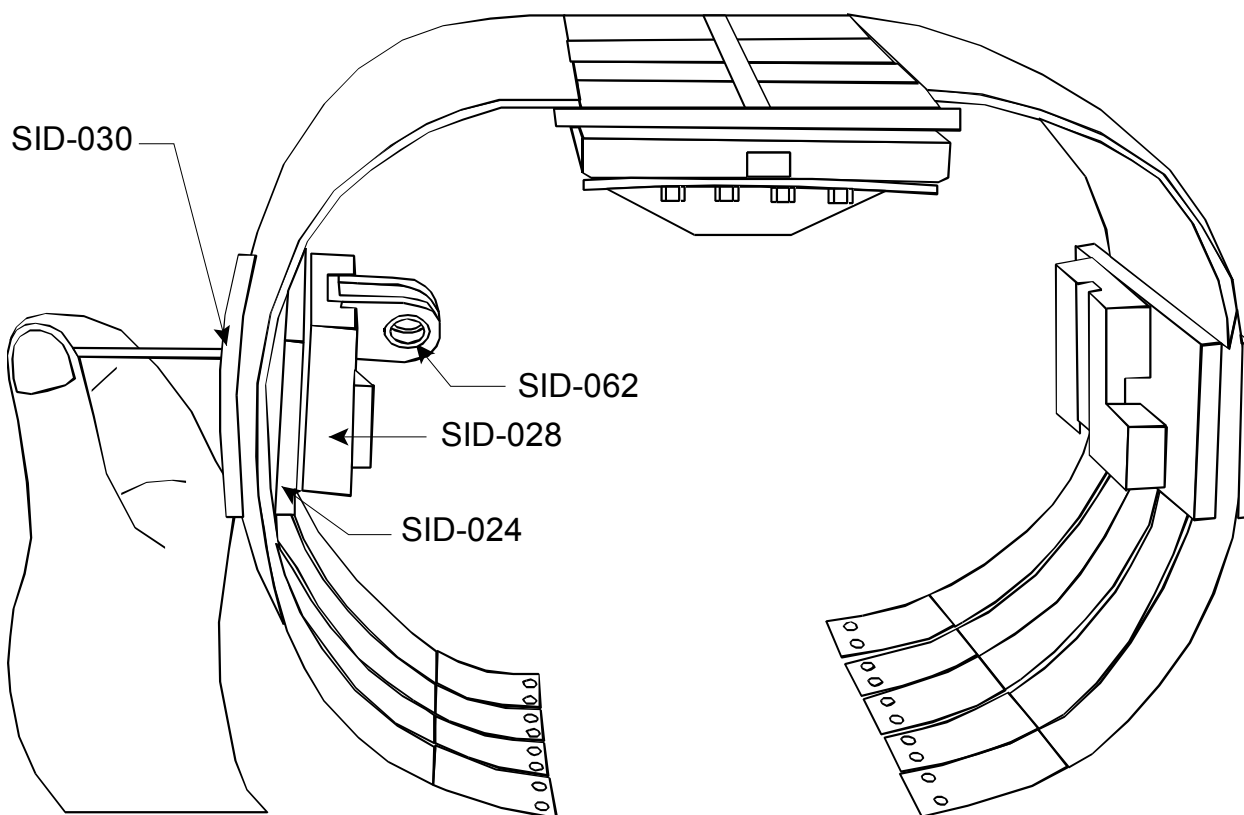
**4.0 FIGURES....Continued**

FIGURE 23  
RIB CUSHION REMOVAL



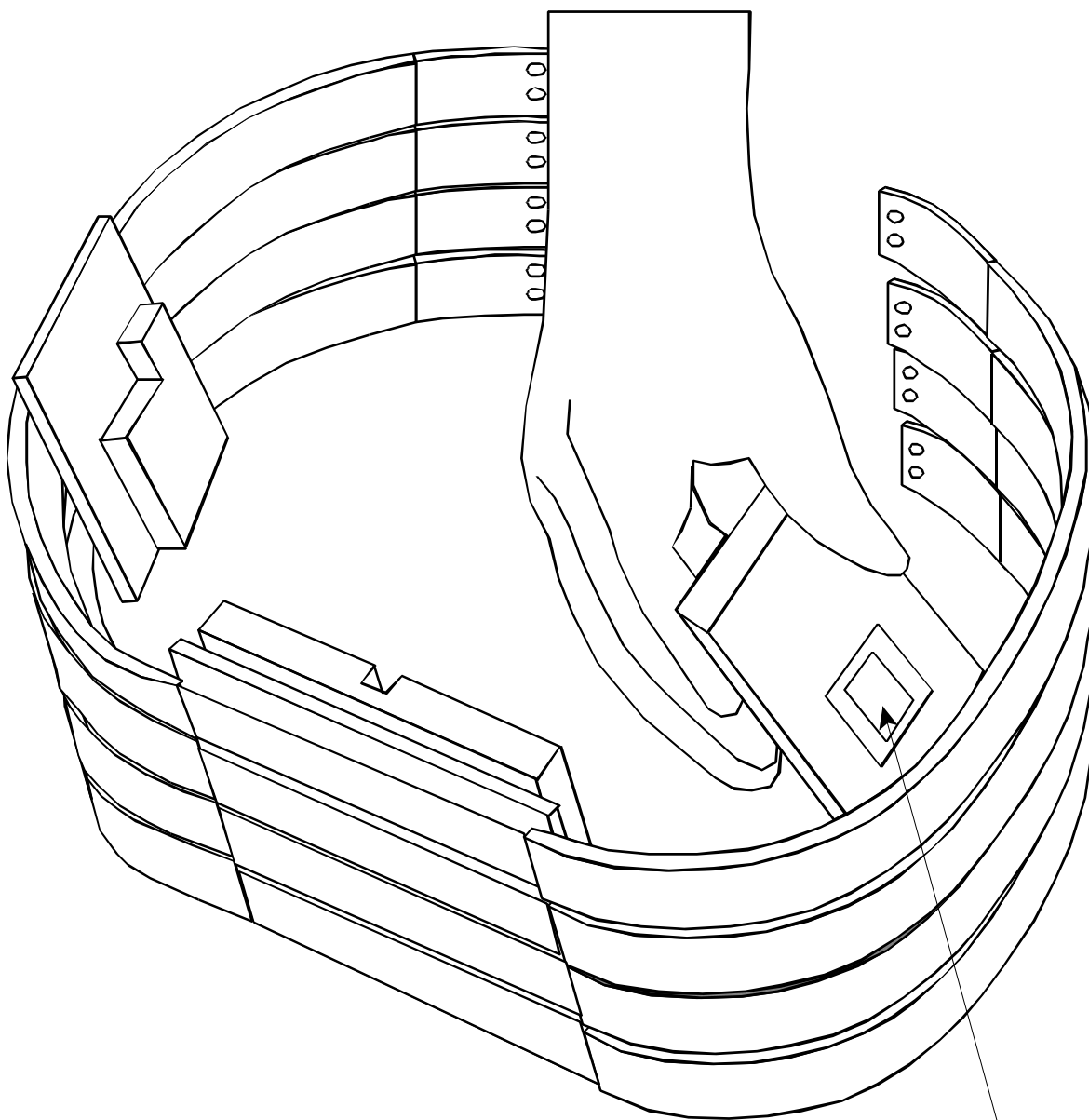
**4.0 FIGURES....Continued**

FIGURE 24  
REMOVAL OF RIB BAR FROM RIBS



**4.0 FIGURES....Continued**

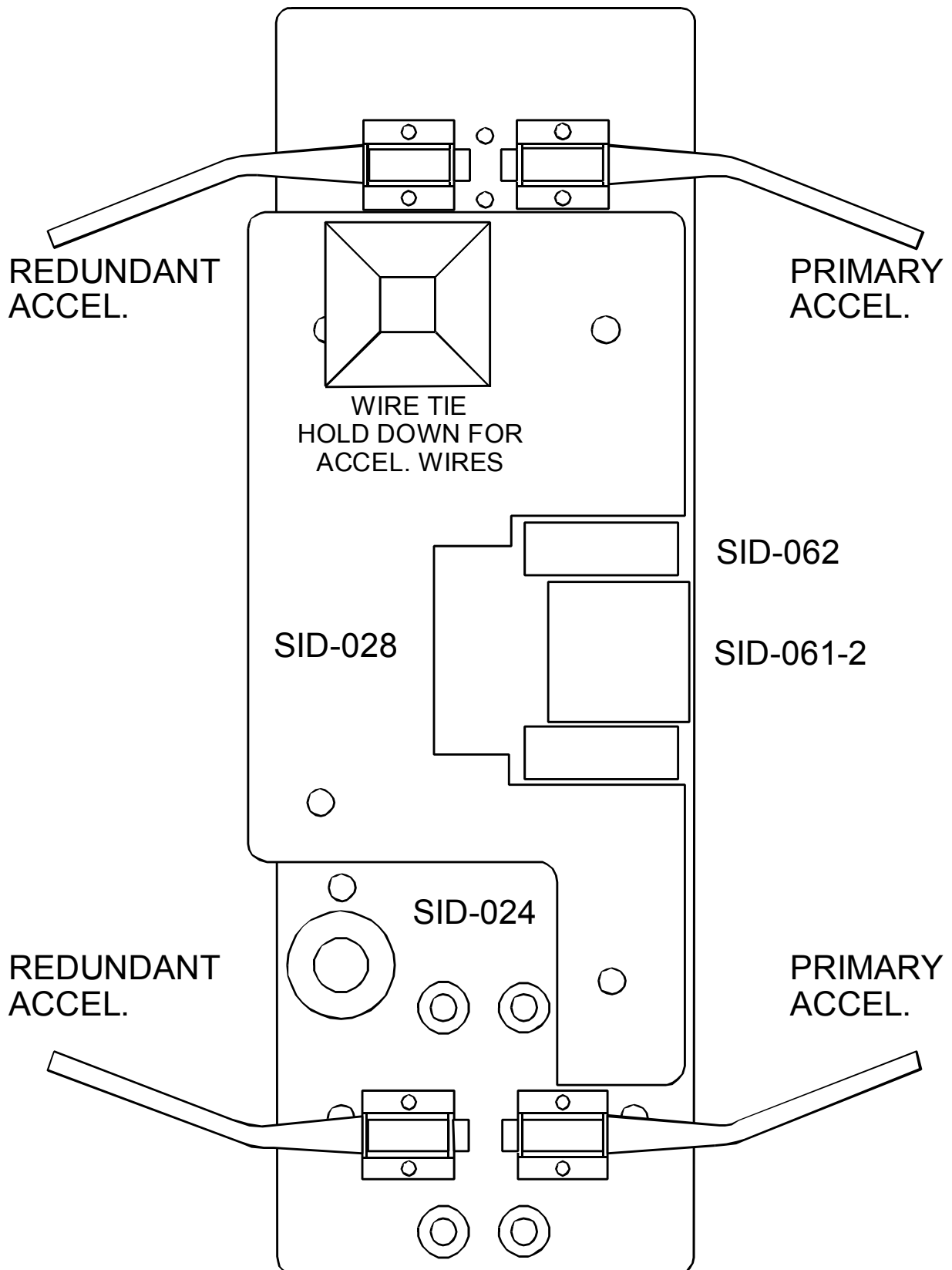
FIGURE 25  
REMOVAL OF RIB BAR CUSHIONS



SID-085

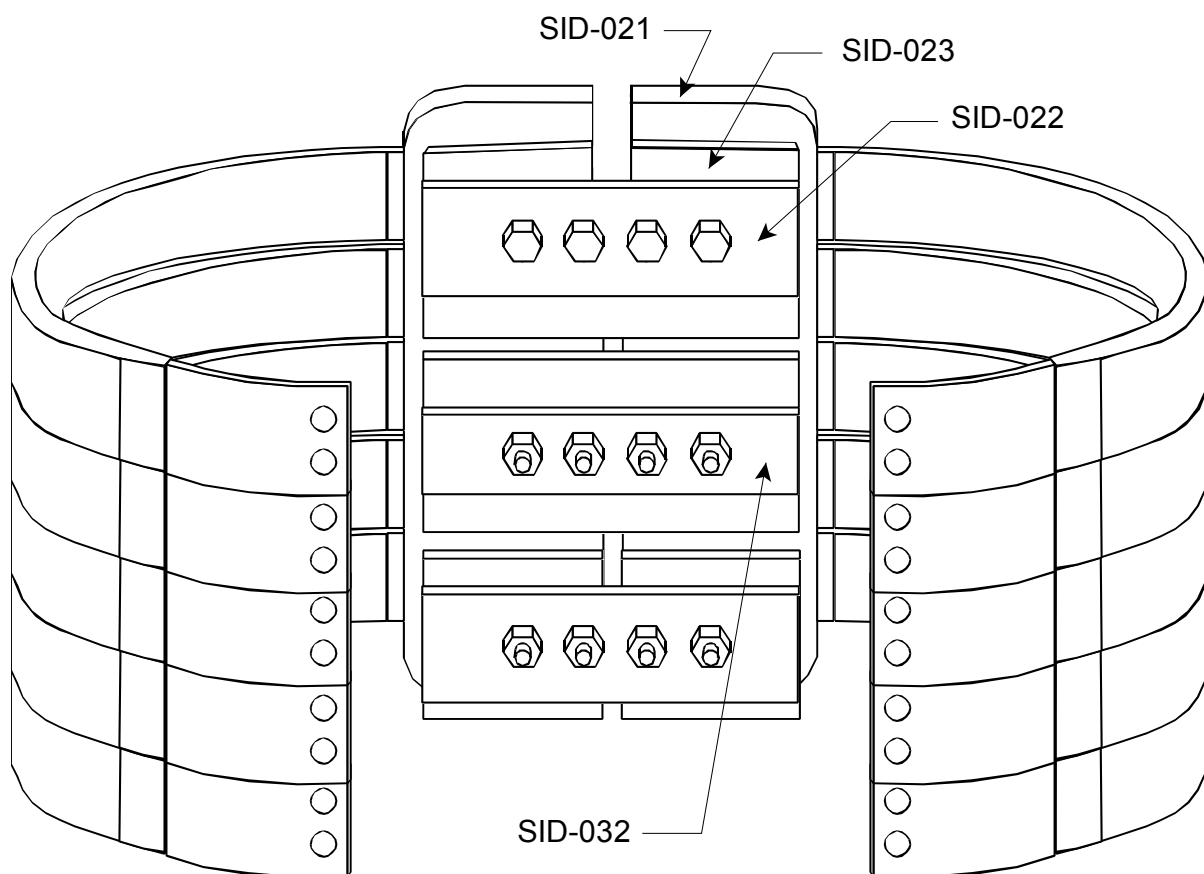
## 4.0 FIGURES....Continued

FIGURE 26  
LOCATION OF CLEVIS AND BALLAST ON RIB BAR



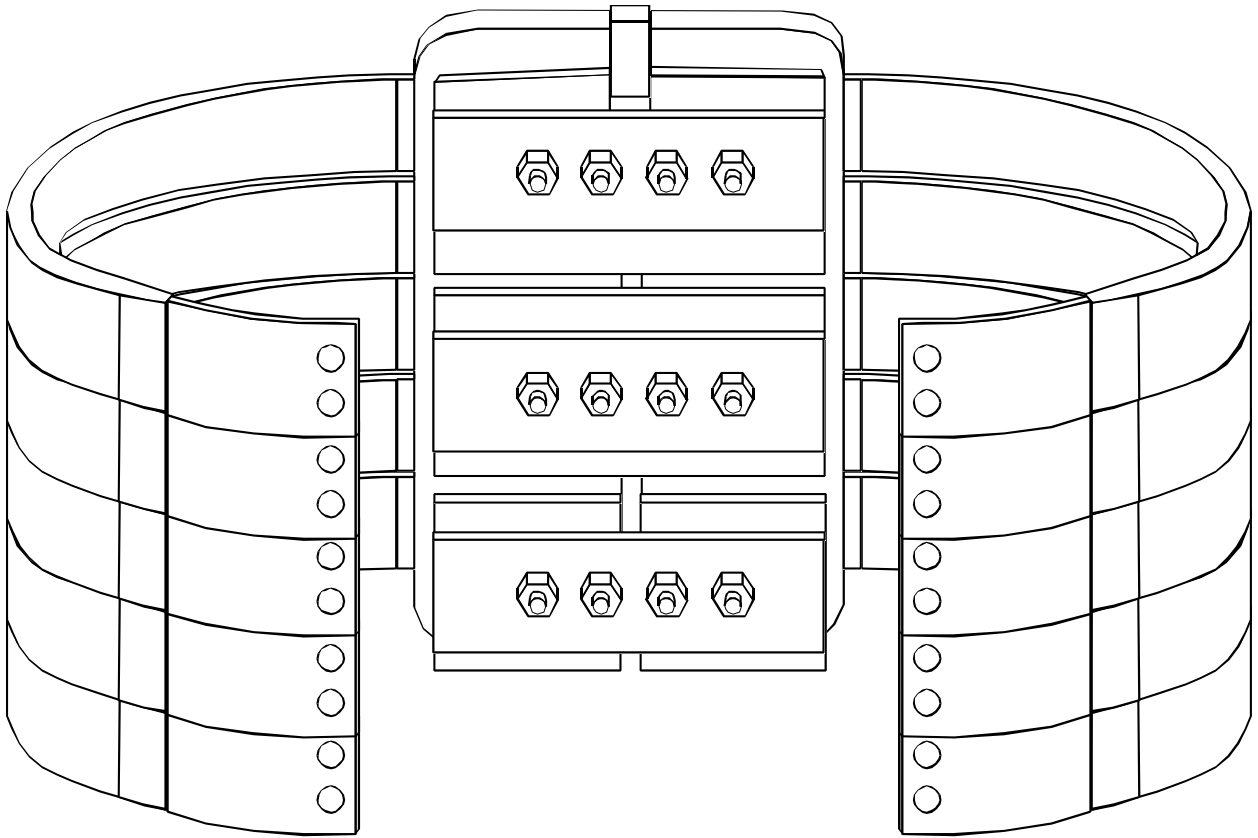
**4.0 FIGURES....Continued**

FIGURE 27  
STERNUM DISASSEMBLY



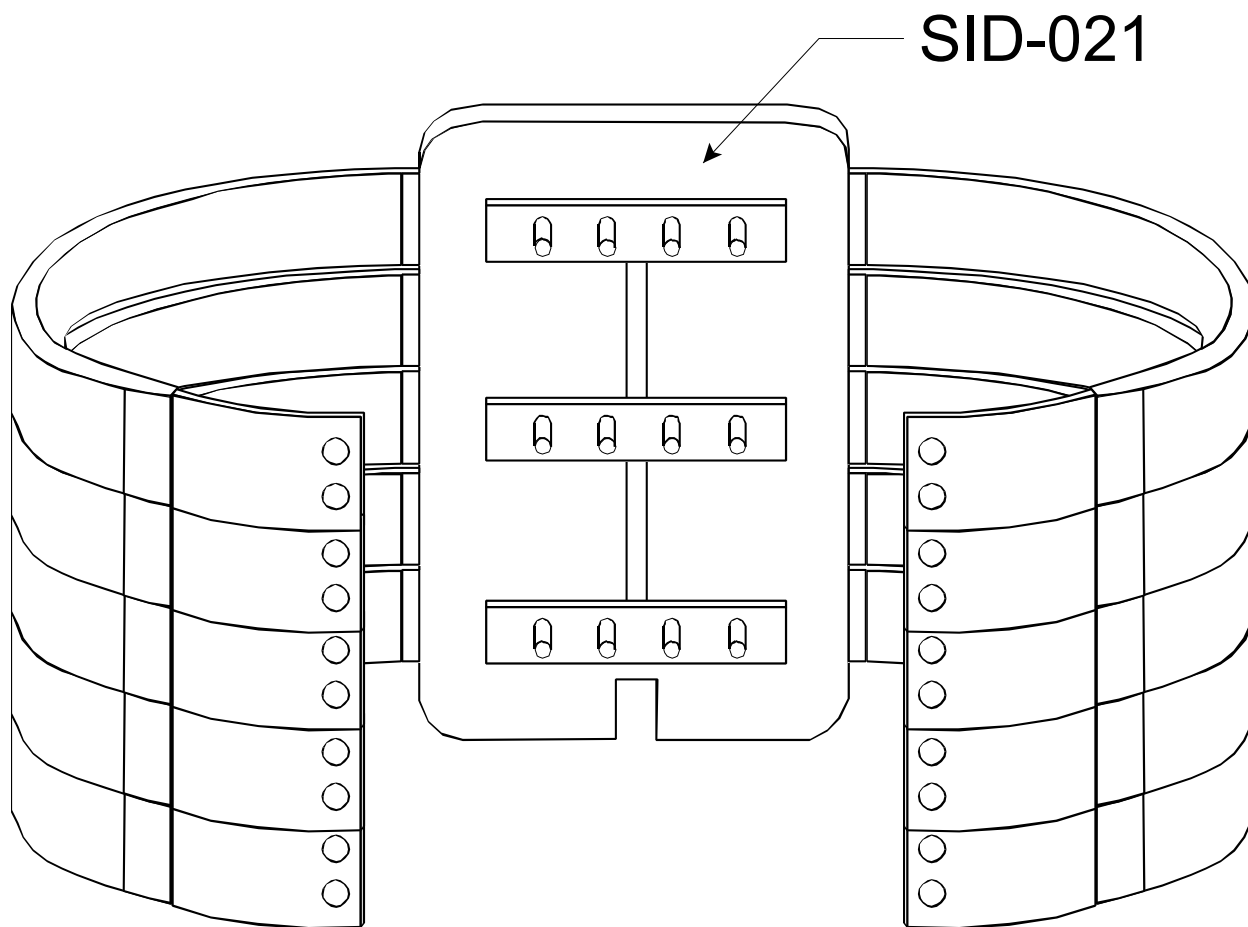
**4.0 FIGURES....Continued**

FIGURE 28  
REMOVAL OF RIB CAGE SUPPORT ANGLE



**4.0 FIGURES....Continued**

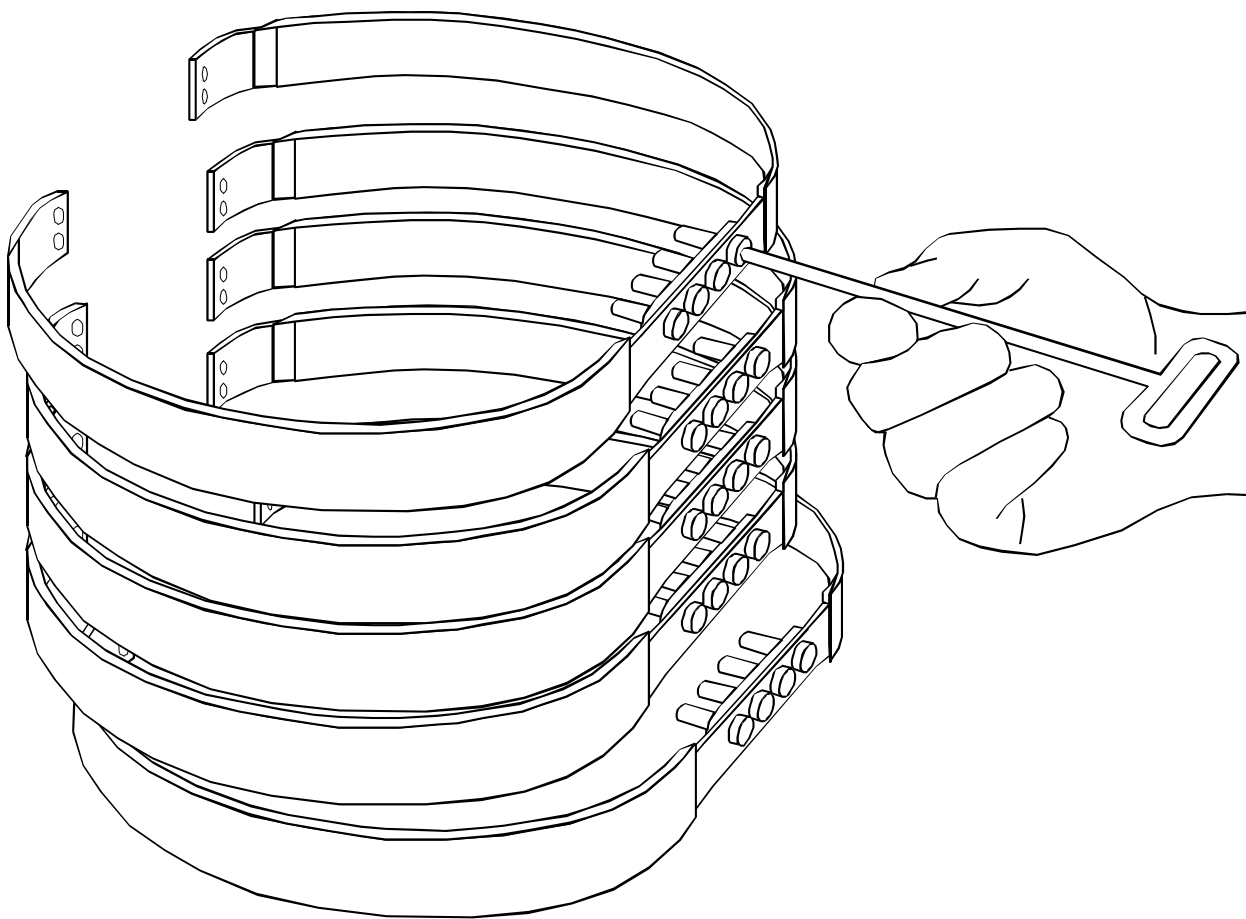
FIGURE 29  
REMOVAL OF STERNUM BALLAST FROM STERNUM



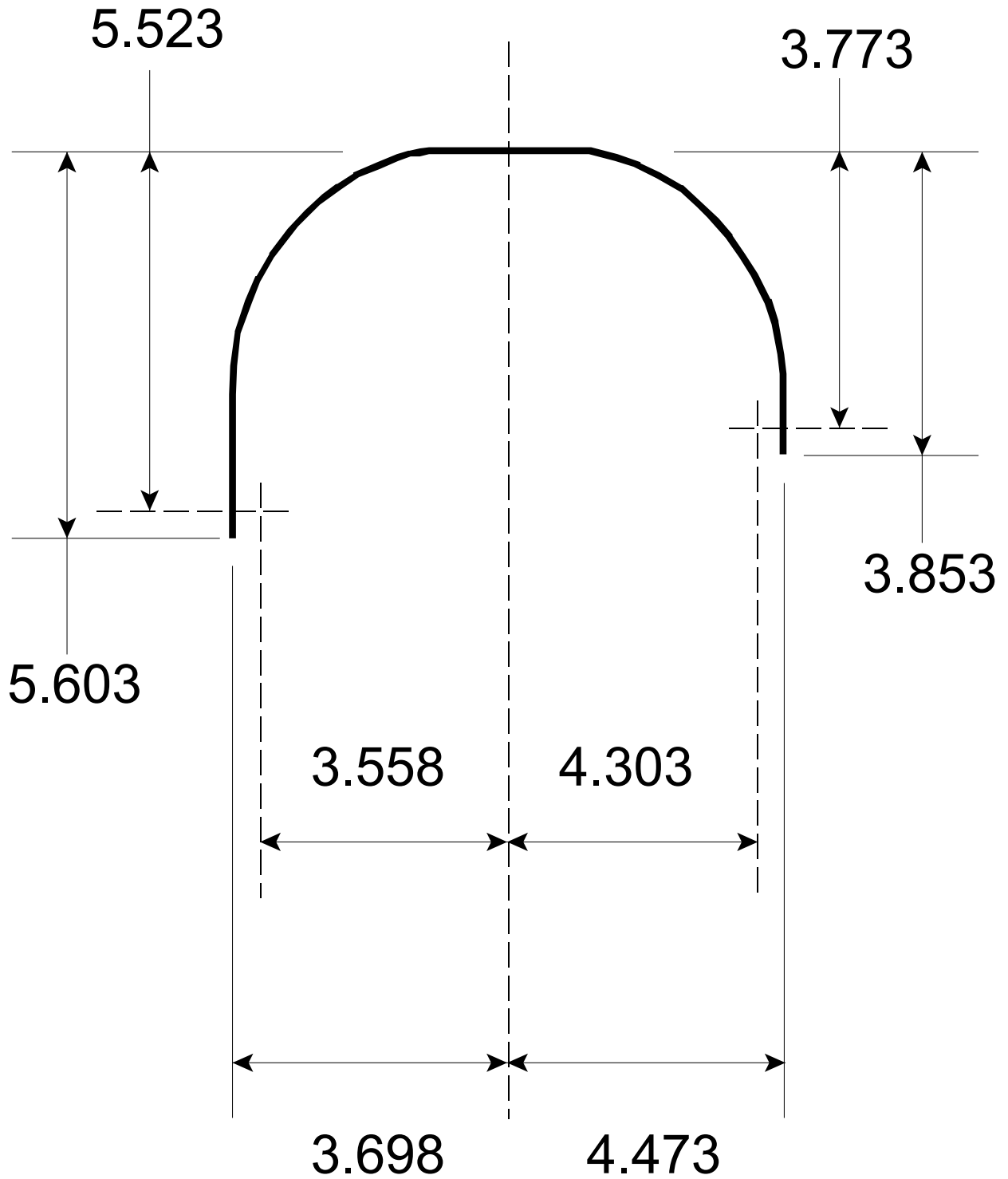


**4.0 FIGURES....Continued**

FIGURE 30  
SEPARATION OF RIBS

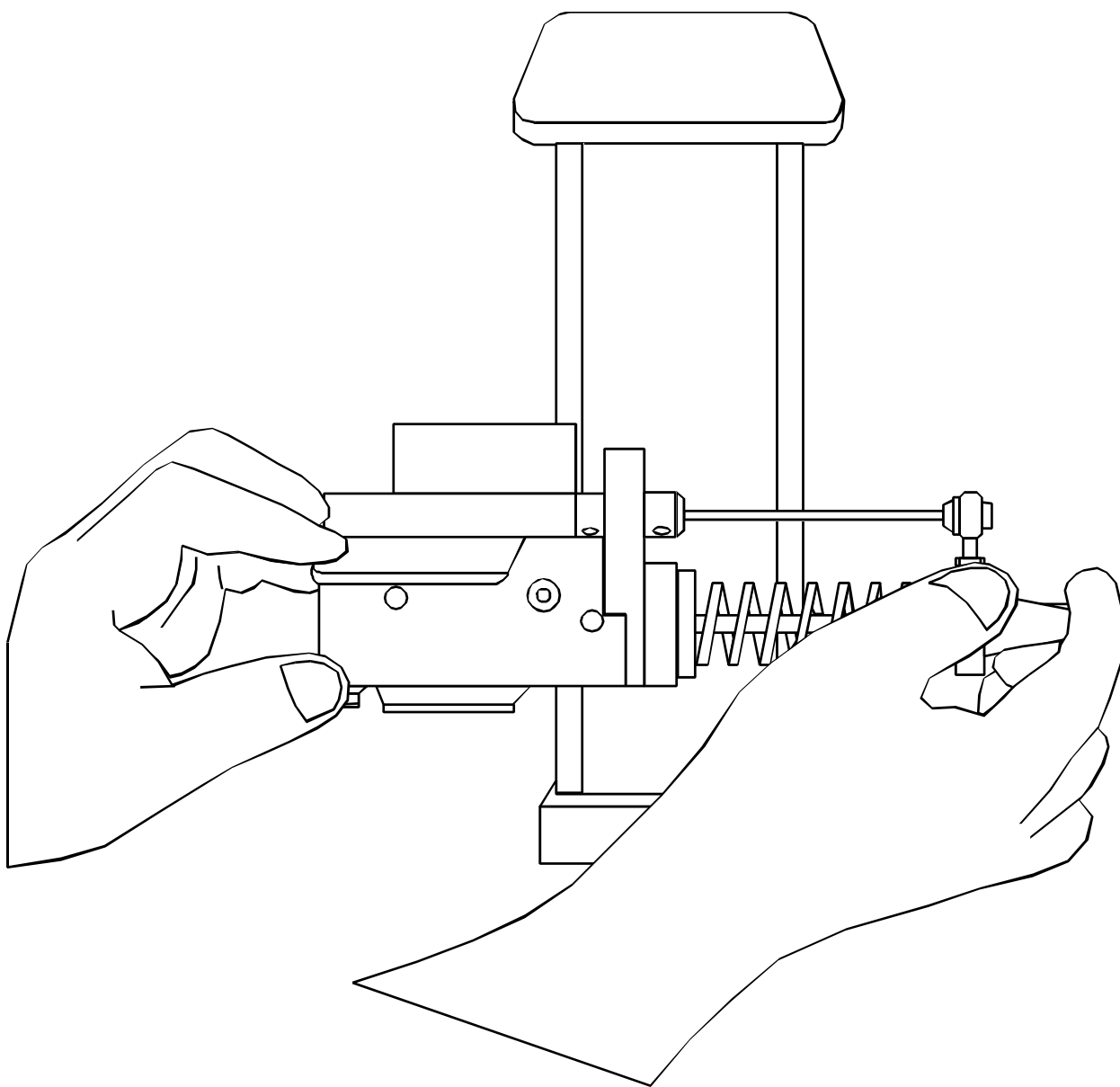


## 4.0 FIGURES....Continued

FIGURE 31  
DIMENSIONS TO OUTSIDE OF STEEL RIB

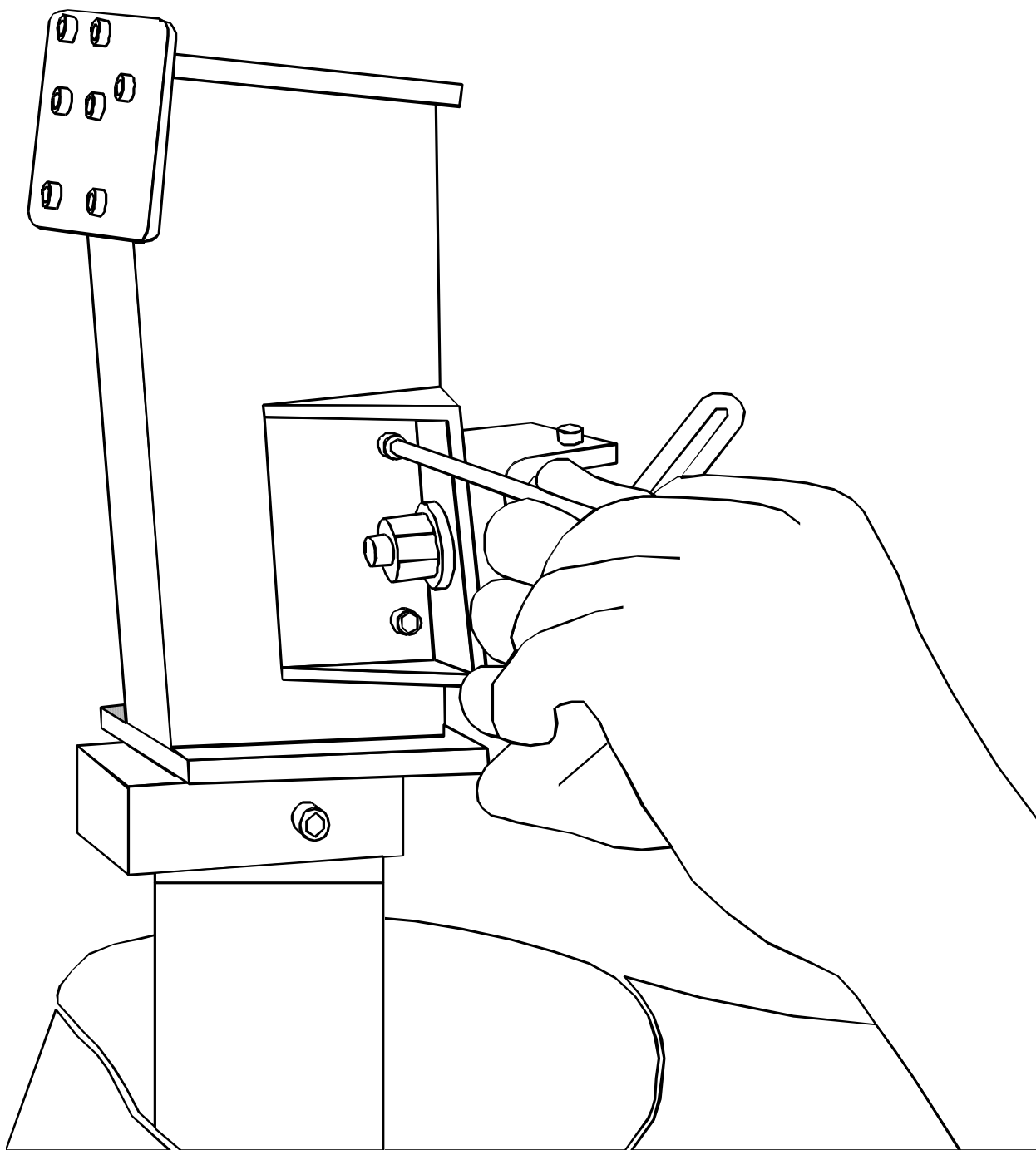
**4.0 FIGURES....Continued**

FIGURE 32  
REMOVAL OF SHOCK ASSEMBLY FROM THORACIC SPINE ASSEMBLY



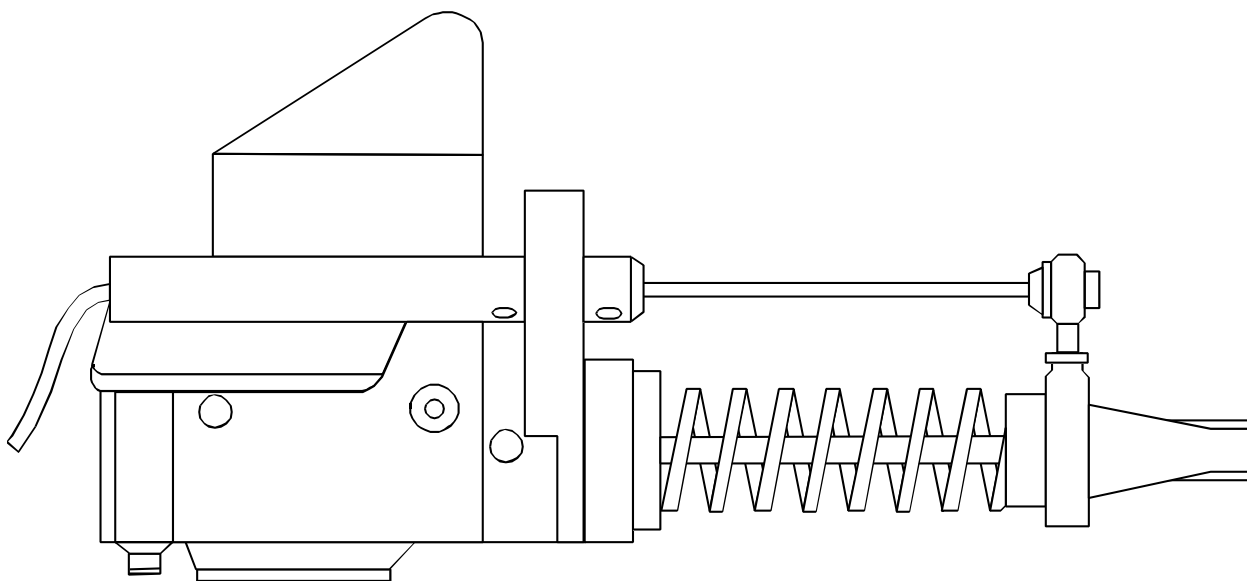
**4.0 FIGURES....Continued**

FIGURE 33  
REMOVAL OF BRACKET FROM THORACIC SPINE



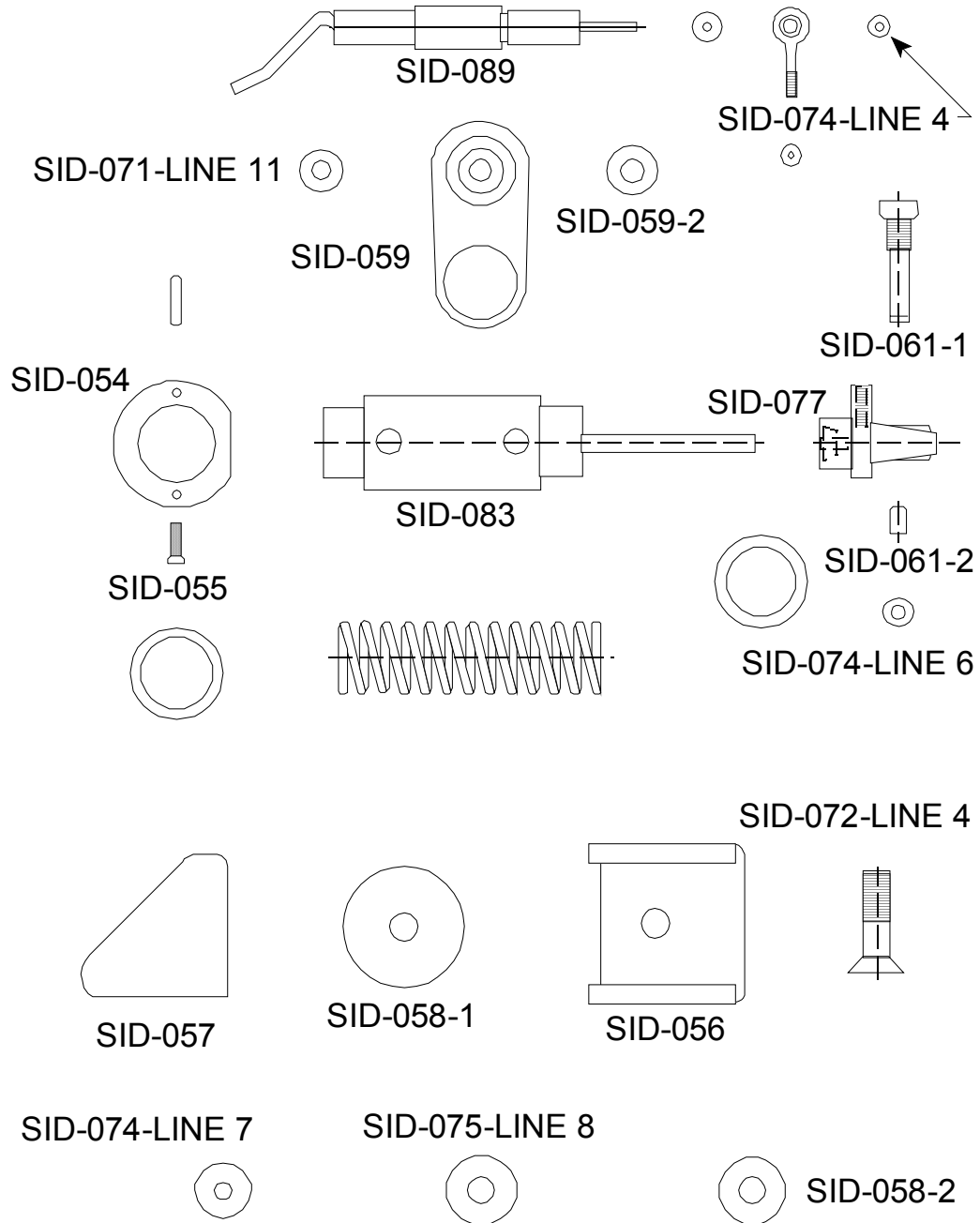
**4.0 FIGURES....Continued**

FIGURE 34  
SHOCK ABSORBER ASSEMBLY



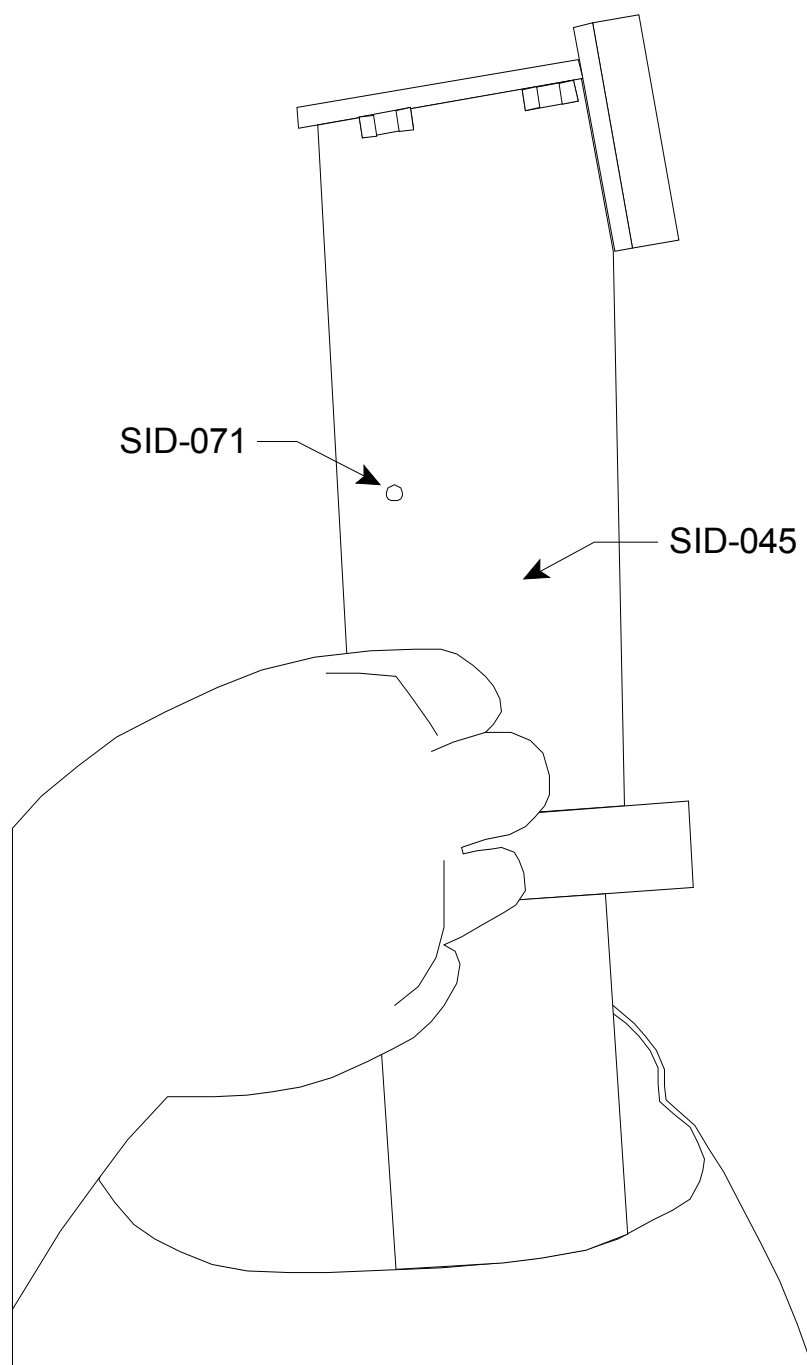
## 4.0 FIGURES....Continued

FIGURE 35  
EXPLODED VIEW OF SHOCK ABSORBER MOUNTING ASSEMBLY



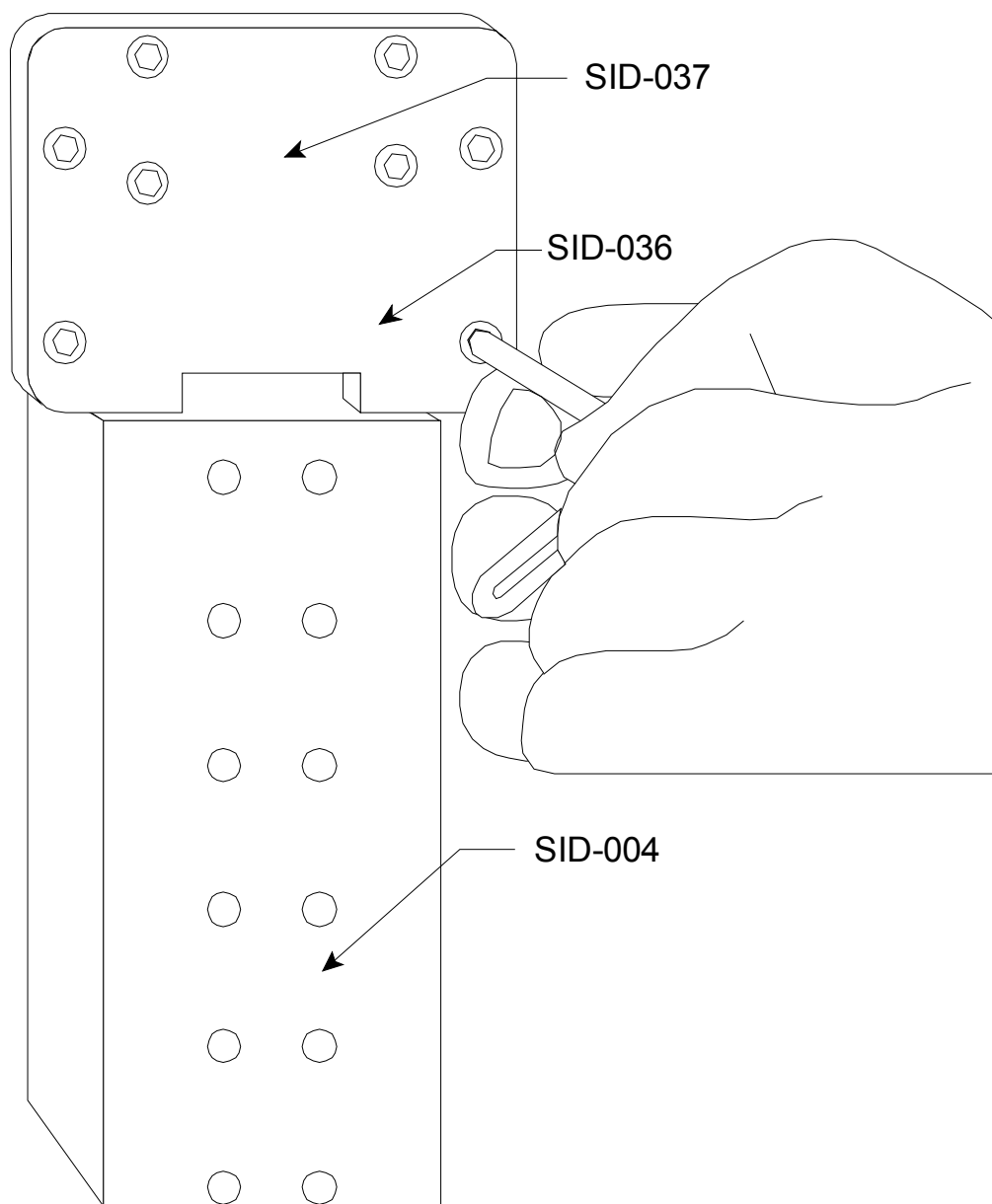
**4.0 FIGURES....Continued**

FIGURE 36  
REMOVAL OF ANTI-BOTTOMING PAD FROM THORACIC SPINE BOX



**4.0 FIGURES....Continued**

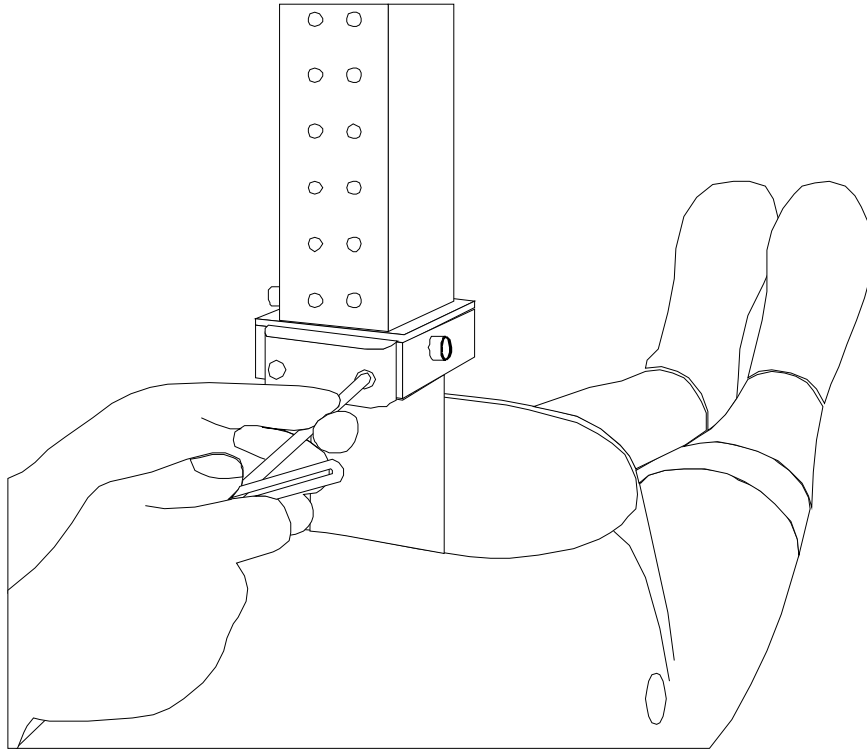
FIGURE 37  
REMOVAL OF ACCELEROMETER MOUNTING PLATE FROM  
THORACIC SPINE BOX





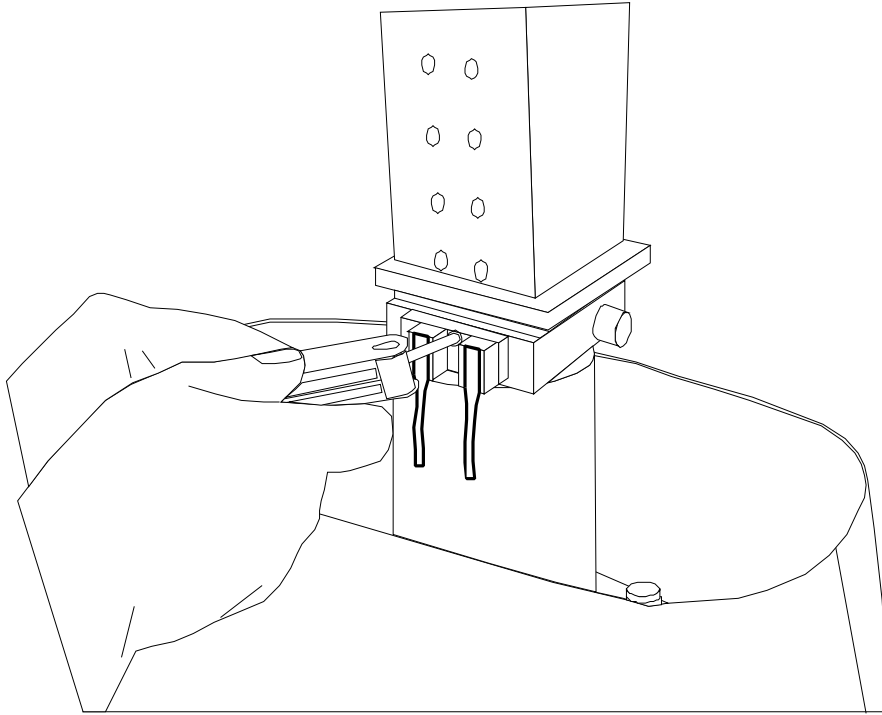
**4.0 FIGURES....Continued**

FIGURE 38  
REMOVAL OF ACCELEROMETER COVER (SID-039) FROM BOTTOM OF SPINE



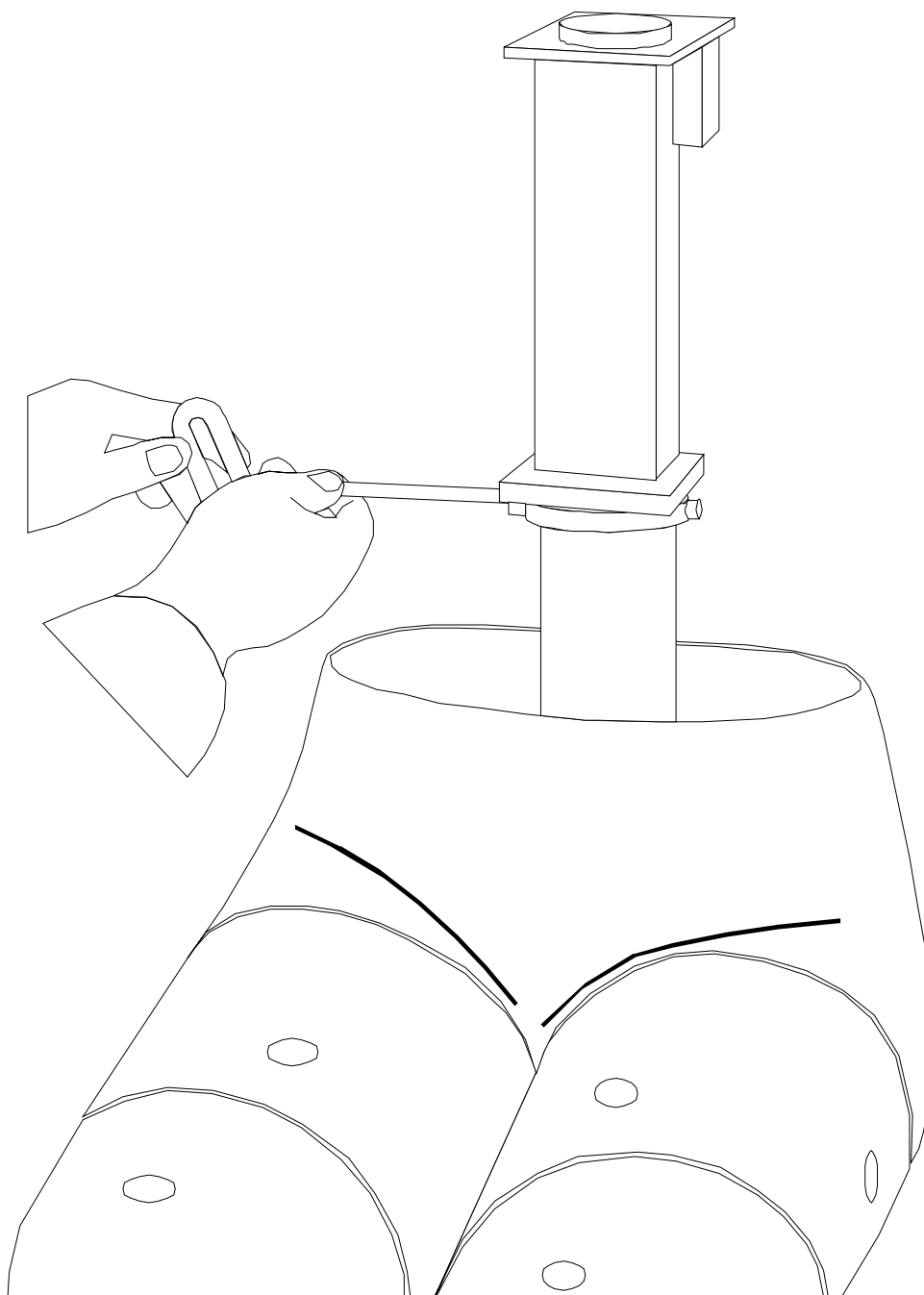
**4.0 FIGURES....Continued**

FIGURE 39  
REMOVAL OF ACCELEROMETER MOUNT (SID-038) FROM SPINE



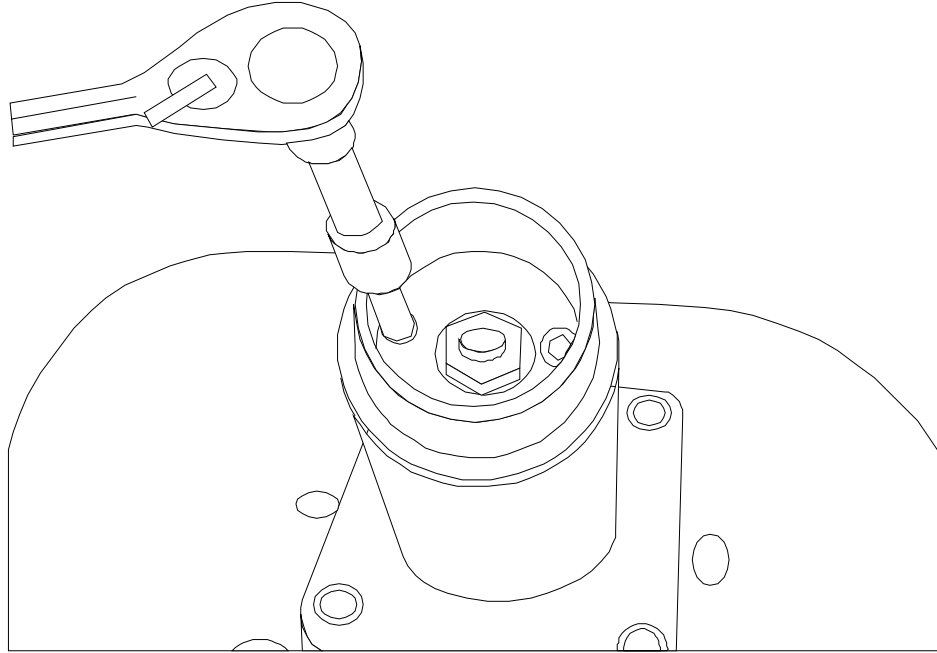
**4.0 FIGURES....Continued**

FIGURE 40  
REMOVAL OF THORACIC SPINE FROM LUMBAR SPINE



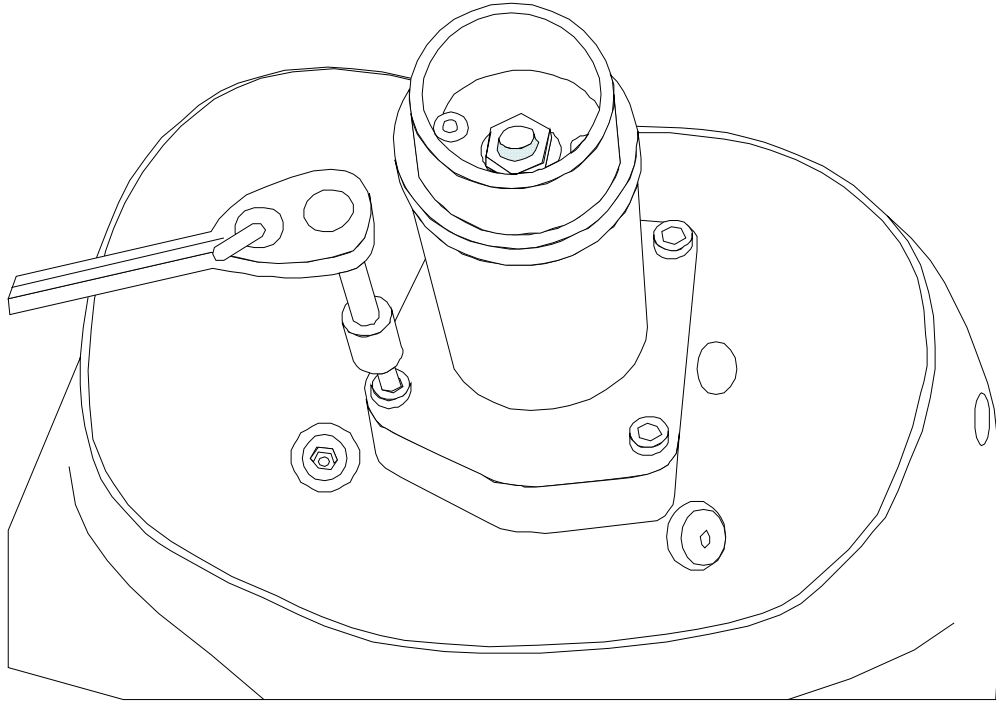
**4.0 FIGURES....Continued**

FIGURE 41  
REMOVAL OF LUMBAR ADAPTOR FROM LUMBAR SPINE



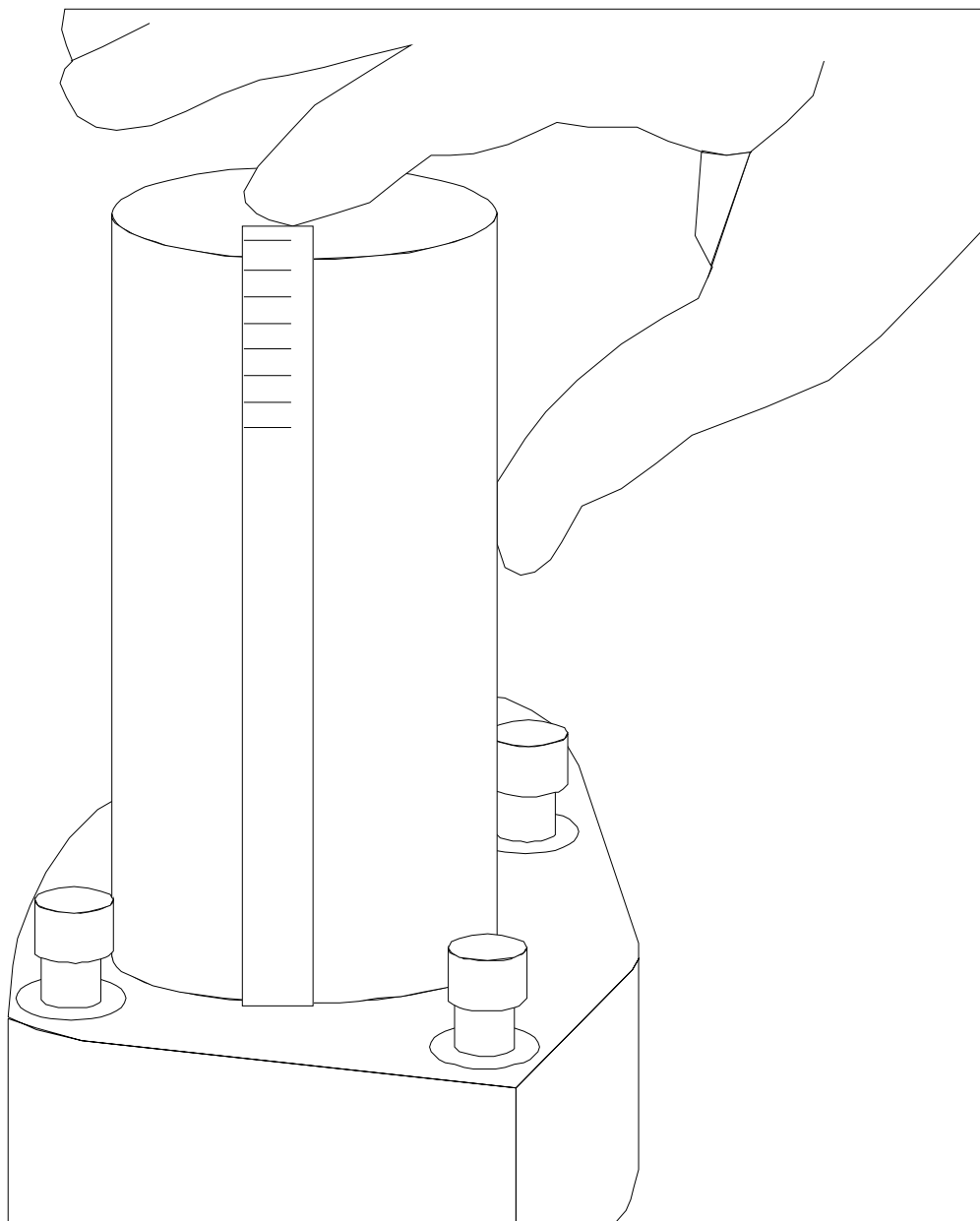
**4.0 FIGURES....Continued**

FIGURE 42  
REMOVAL OF LUMBAR SPINE AND PELVIC ADAPTOR ASSEMBLY FROM PELVIS



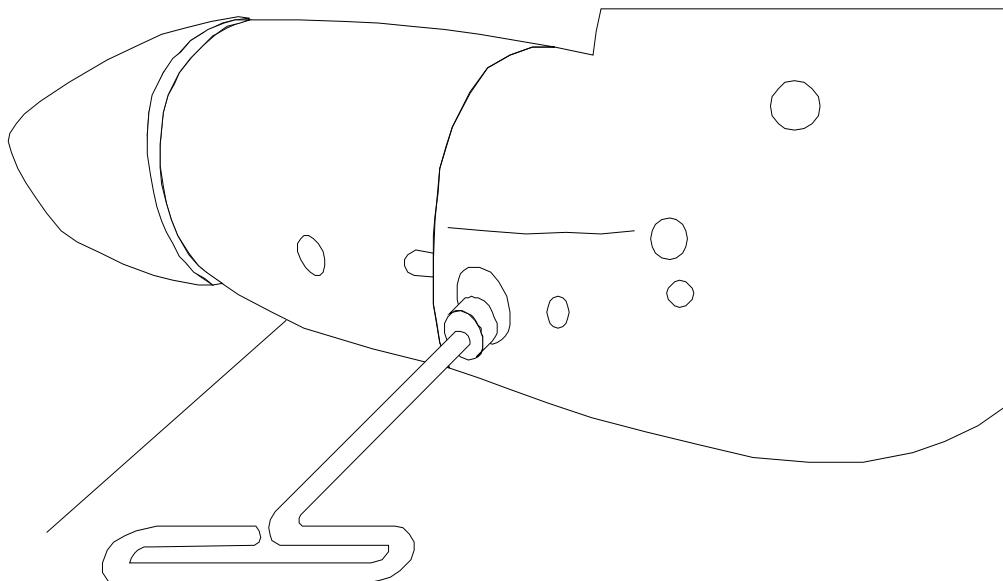
**4.0 FIGURES....Continued**

**FIGURE 43**  
**INSPECTION OF LUMBAR SPINE**



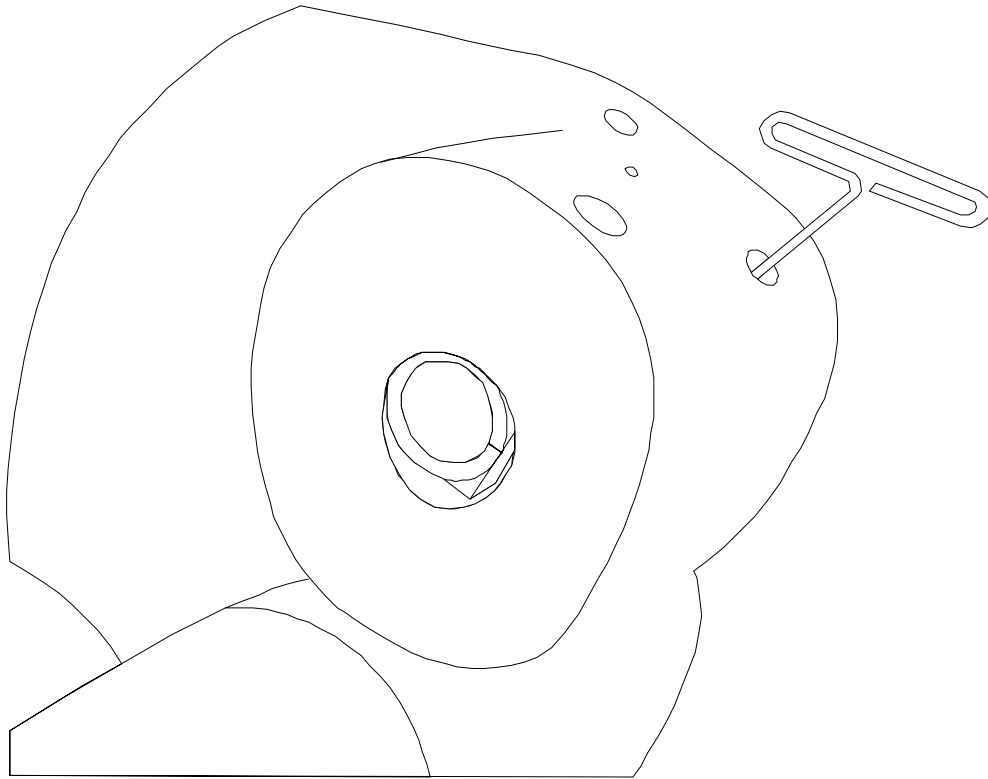
**4.0 FIGURES....Continued**

FIGURE 44  
REMOVAL OF SHOULDER BOLTS FROM UPPER FEMURS



**4.0 FIGURES....Continued**

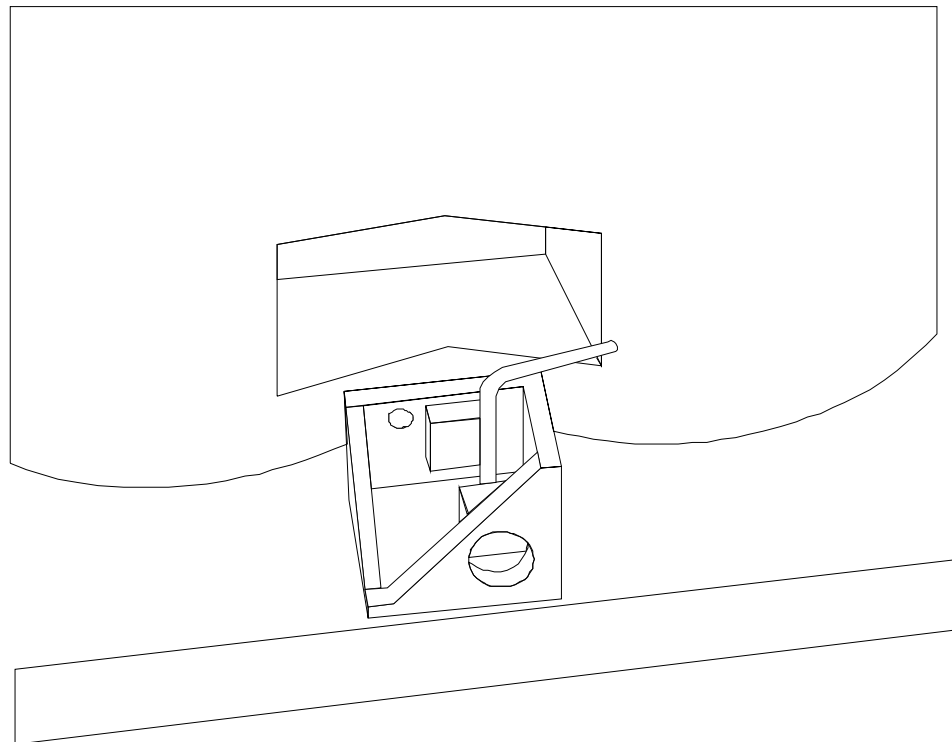
FIGURE 45  
REMOVAL OF FEMUR BALL AND FLANGE ASSEMBLY





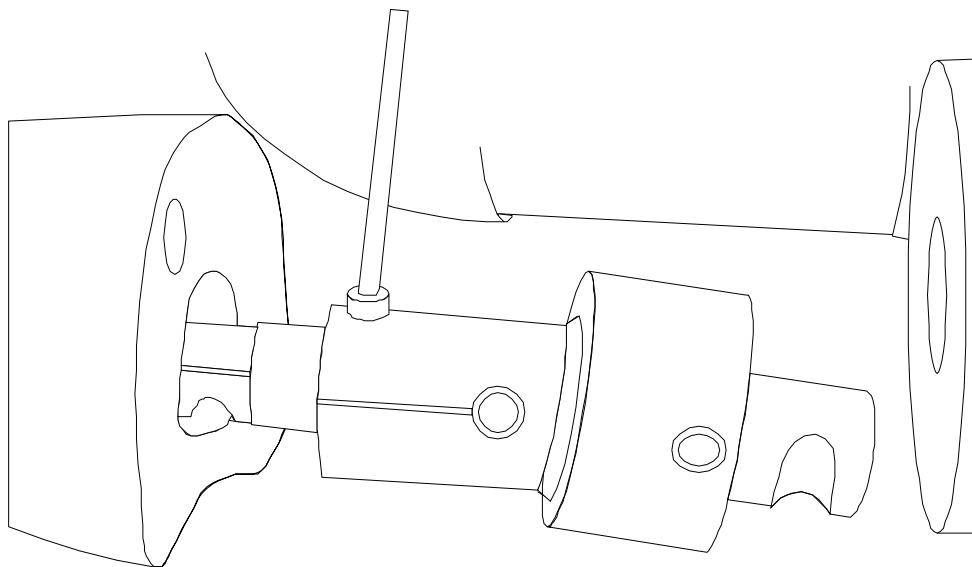
**4.0 FIGURES....Continued**

FIGURE 46  
REMOVAL OF ACCELEROMETER MOUNTING BLOCK



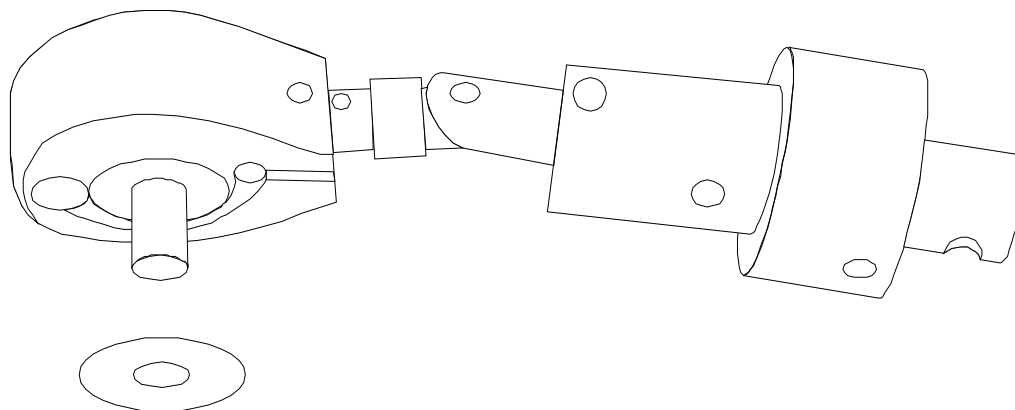
**4.0 FIGURES....Continued**

FIGURE 47  
SEPARATION OF UPPER LEG SECTIONS



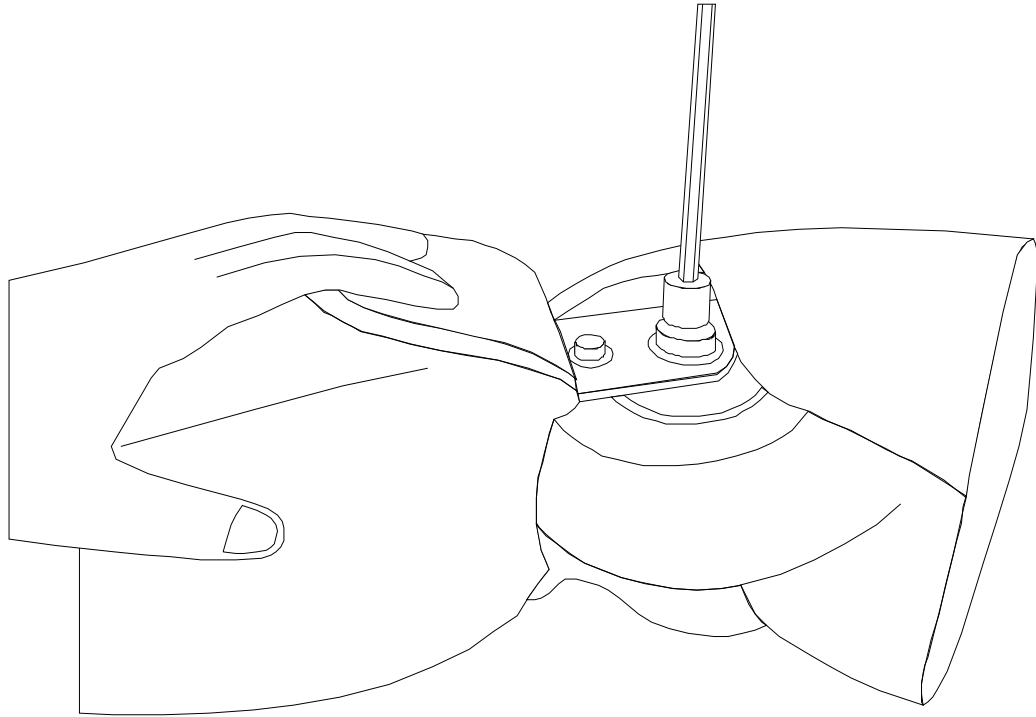
**4.0 FIGURES....Continued**

FIGURE 48  
INSPECTION OF KNEE POST ASSEMBLY



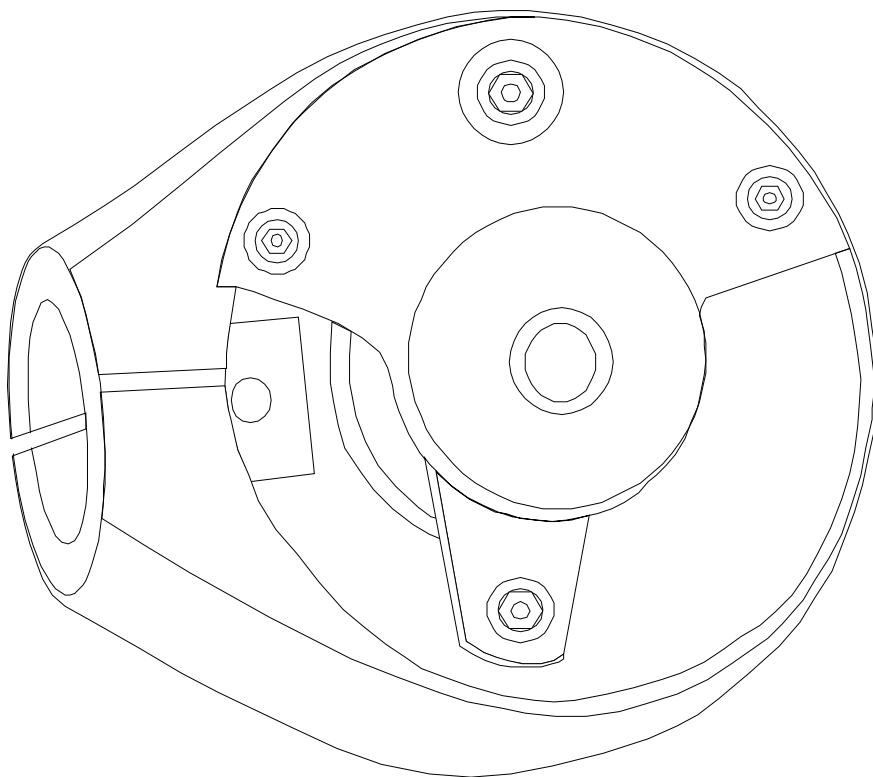
**4.0 FIGURES....Continued**

FIGURE 49  
SEPARATION OF LOWER LEG FROM KNEE CASTING



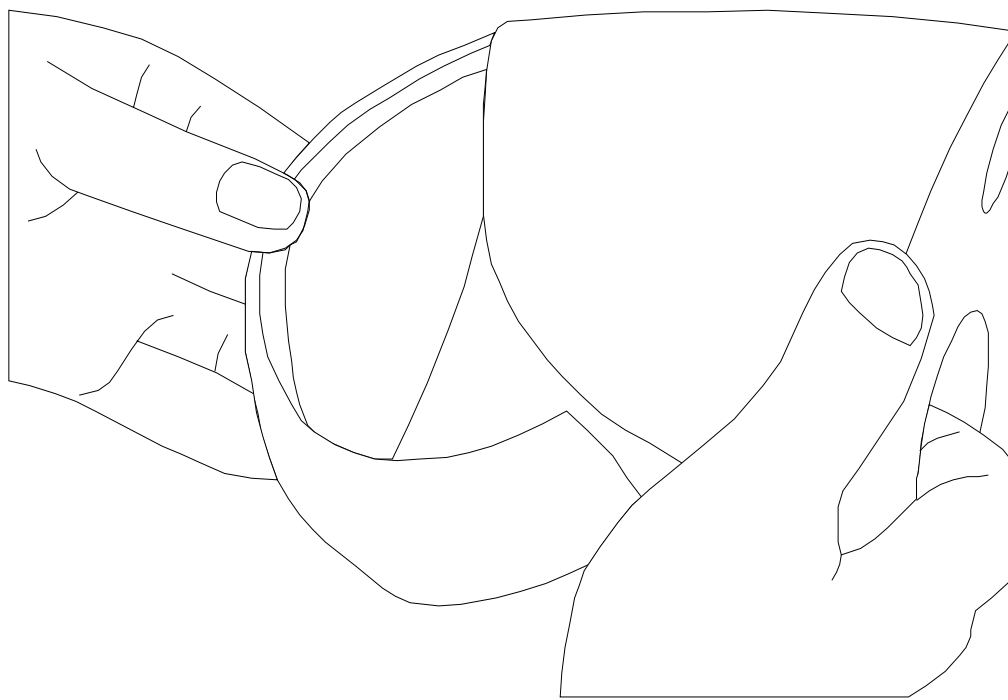
**4.0 FIGURES....Continued**

FIGURE 50  
INSPECTION OF KNEE JOINT



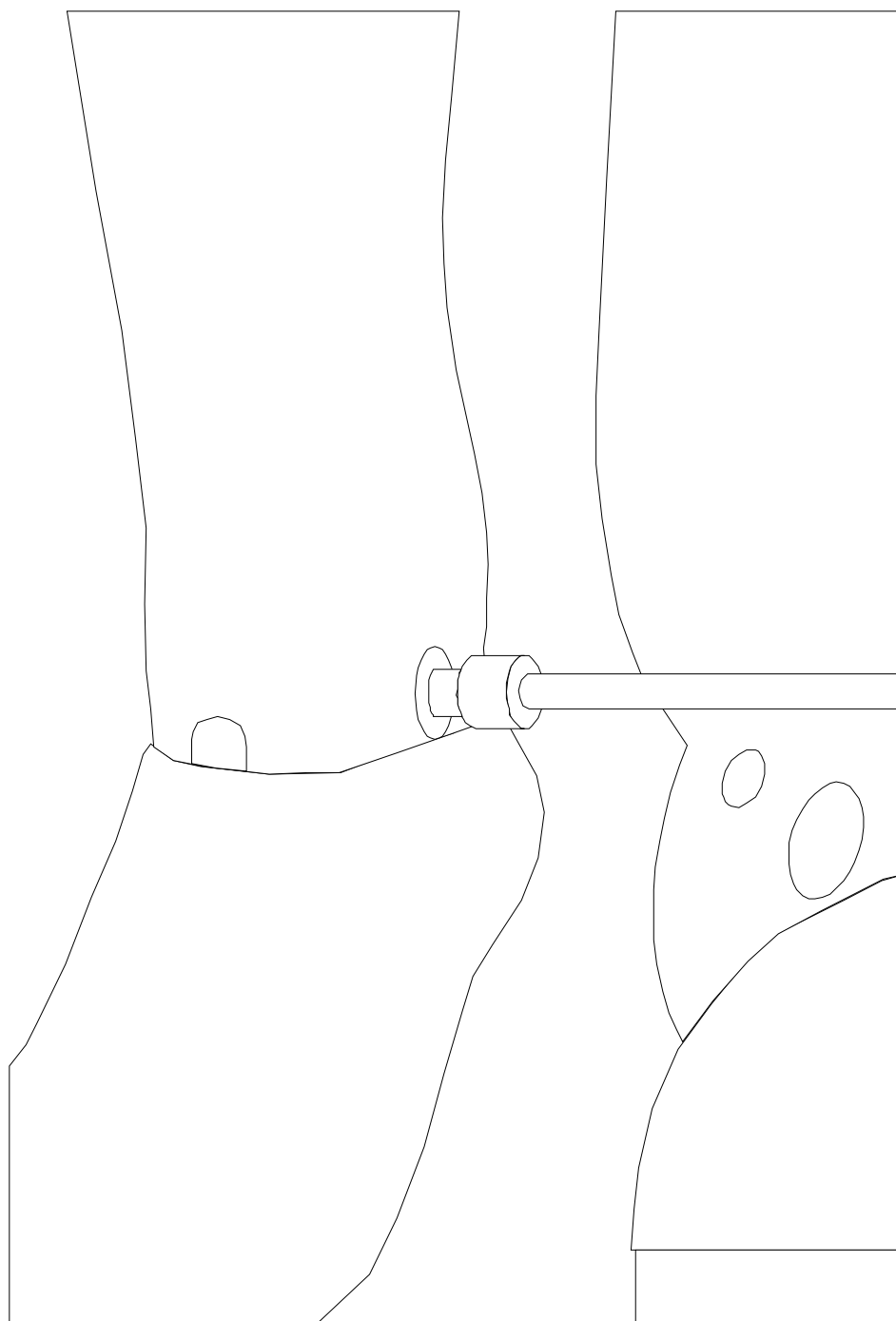
**4.0 FIGURES....Continued**

FIGURE 51  
INSPECTION OF KNEE SKIN



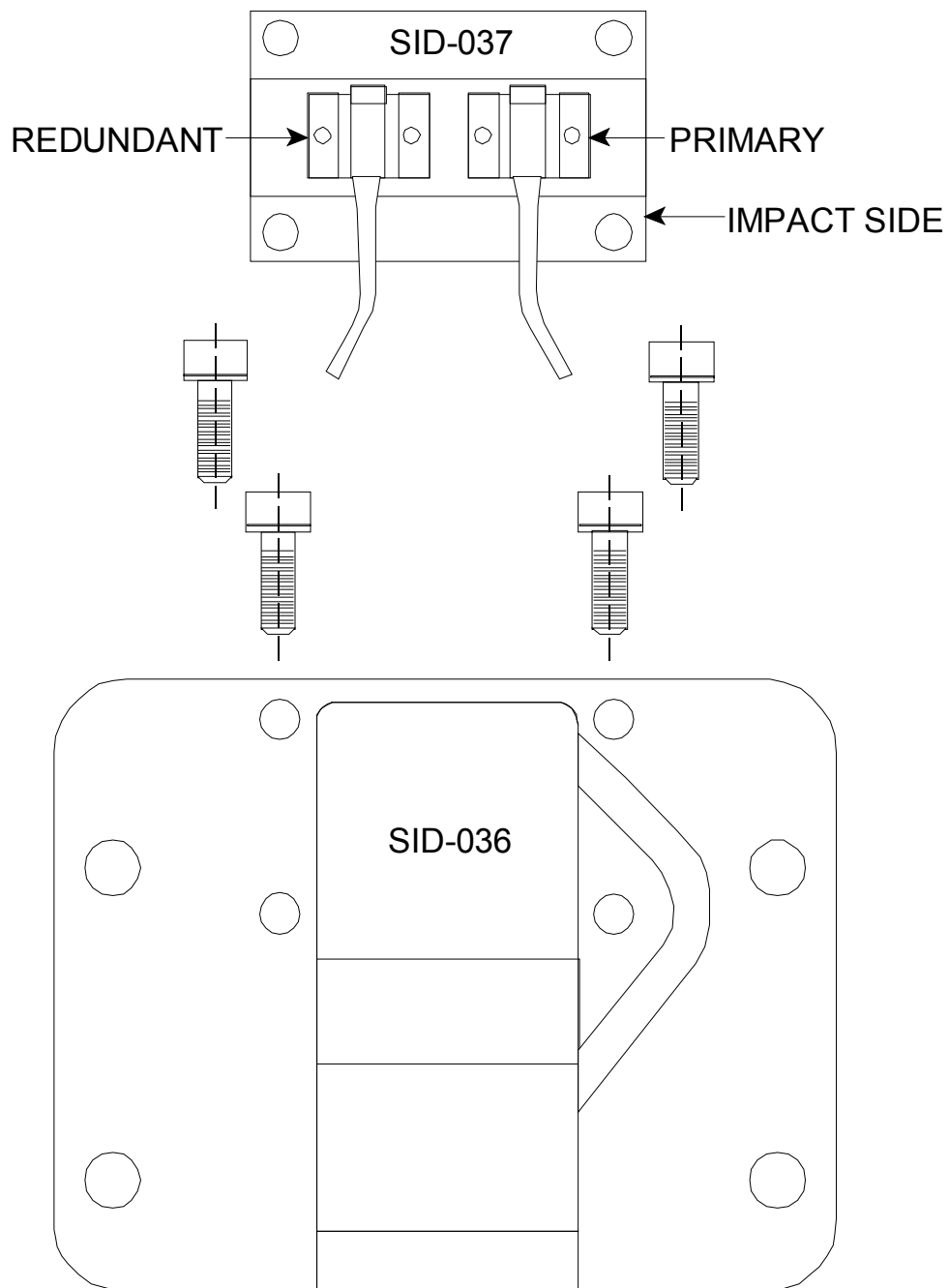
**4.0 FIGURES....Continued**

FIGURE 52  
SEPARATION OF FOOT AND ANKLE ASSEMBLY



**4.0 FIGURES....Continued**

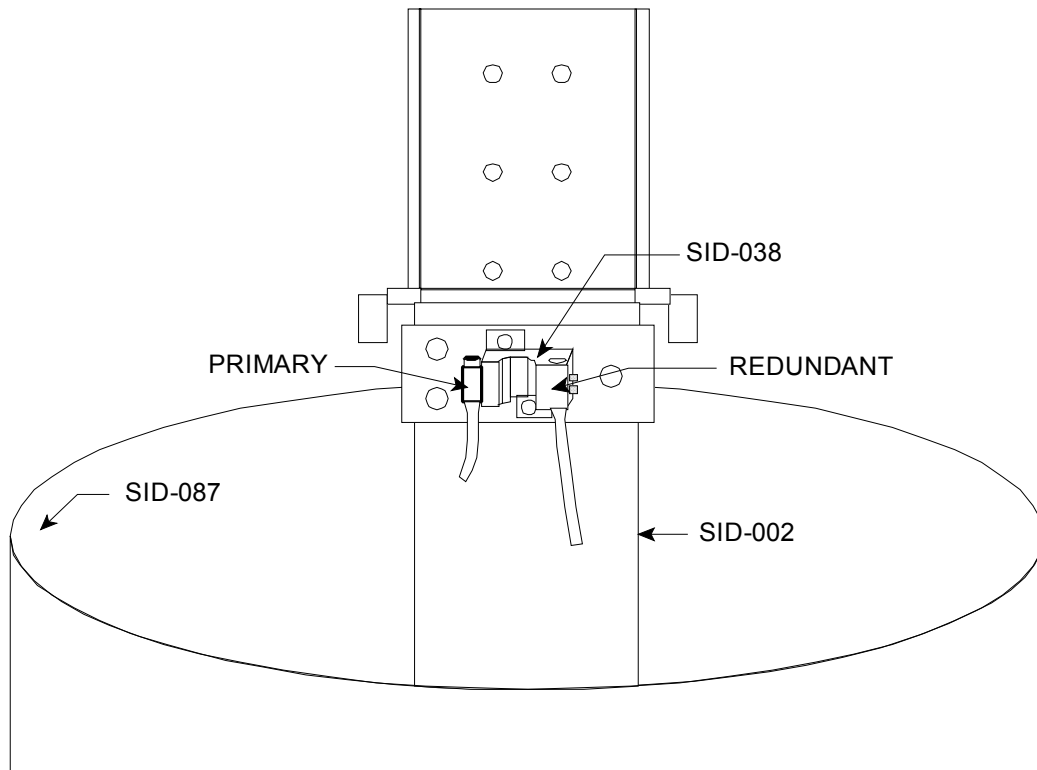
FIGURE 53  
ACCELEROMETER MOUNTING PLATE





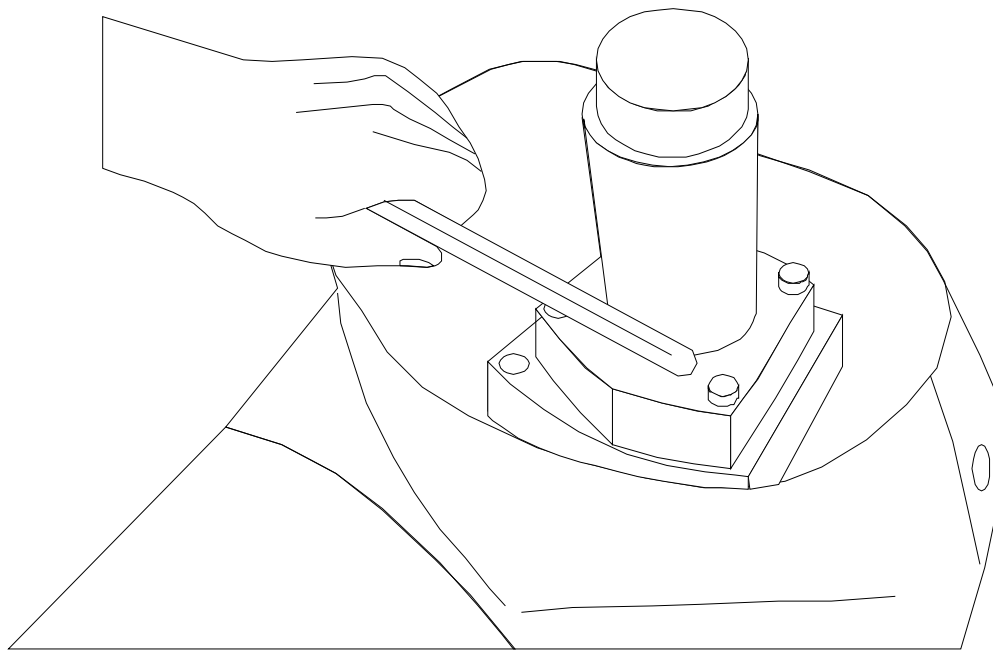
**4.0 FIGURES....Continued**

**FIGURE 54  
ACCELEROMETER PLACEMENT**



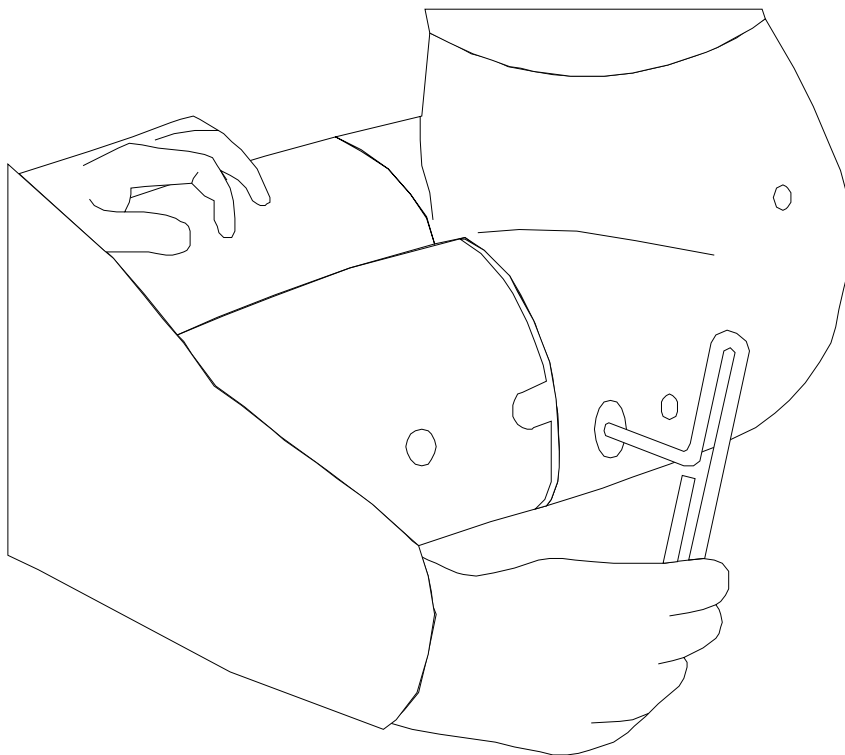
**4.0 FIGURES....Continued**

FIGURE 55  
ADJUSTMENT OF HIP JOINT PLUNGER



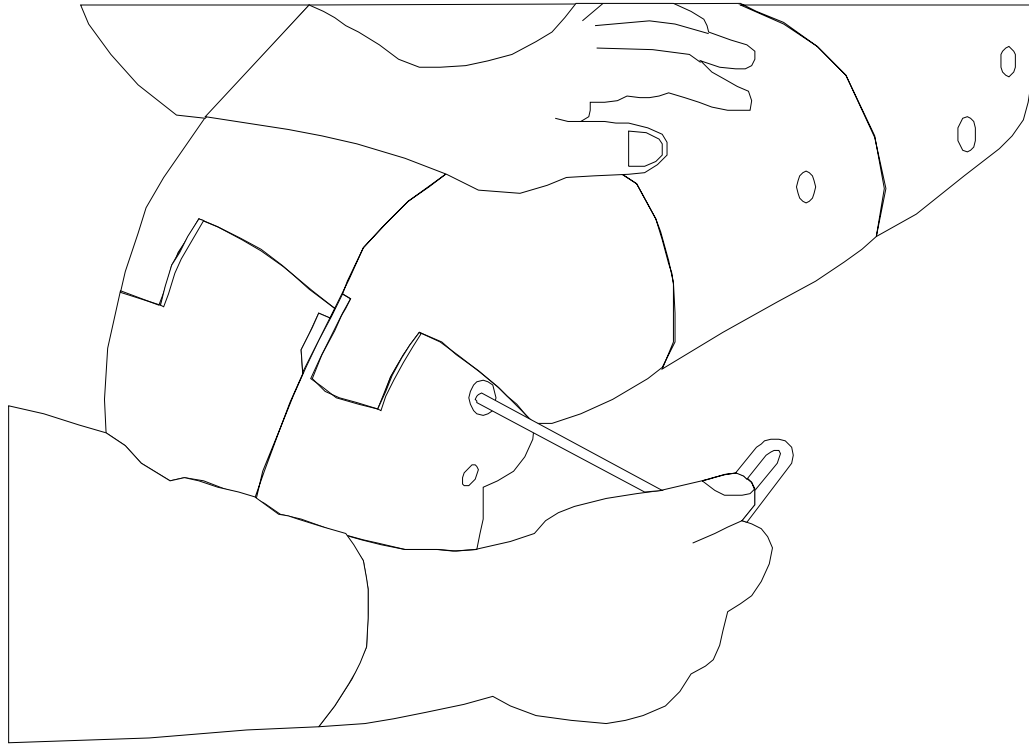
**4.0 FIGURES....Continued**

**FIGURE 56**  
**TIGHTEN HIP JOINT SHOULDER BOLT**



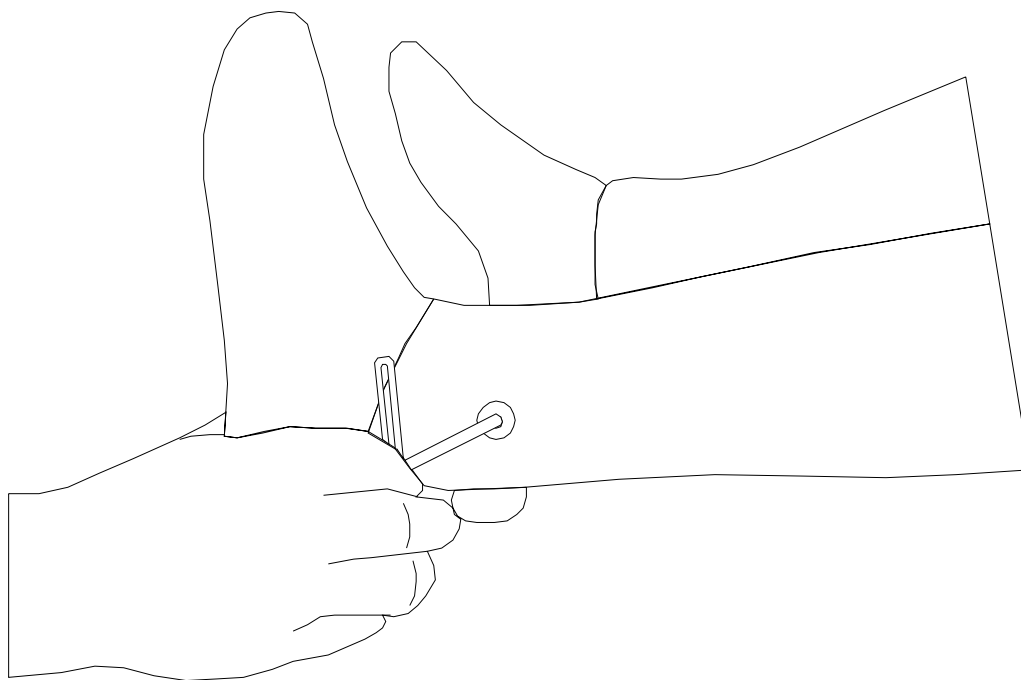
**4.0 FIGURES....Continued**

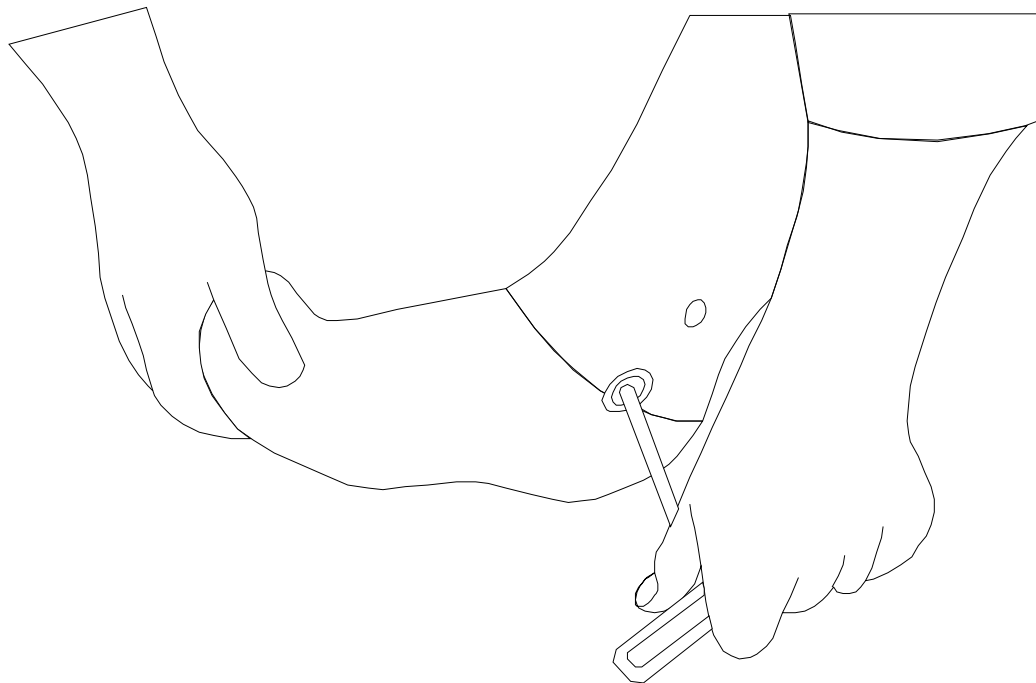
**FIGURE 57**  
**TIGHTEN KNEE JOINT ROTATIONAL BOLT**



**4.0 FIGURES....Continued**

**FIGURE 58**  
**TIGHTEN RIGHT FOOT ROTATIONAL BOLT**



**4.0 FIGURES....Continued****FIGURE 59****TIGHTEN RIGHT FOOT BOLT FOR SUPPORTING WEIGHT OF FOOT**

**4.0 FIGURES....Continued**

FIGURE 60  
SIDE IMPACT DUMMY CONFIGURATION TEST DATA

<b>SYMB</b>	<b>DESCRIPTION</b>	<b>SPECIFICATIO N</b>	<b>PRETEST</b>	<b>POST TEST</b>
SH	Seated Height	35.0 - 35.8		
RH	Rib Height	19.75 - 20.50		
HP	Hip Pivot Height	3.9 REF		
RD	Rib from Backline	9.0 - 9.5		
KH	Knee Pivot from Backline	20.1 - 20.7		
KV	Knee Pivot to Floor	19.3 - 19.9		
HW	Hip Width	14.0 - 15.4		
RW	Rib Width from Centerline*	6.5 - 7.1		

\* The difference between the top and bottom of the rib wrap should be no more than 0.1"

See Figure on next page

## 4.0 FIGURES....Continued

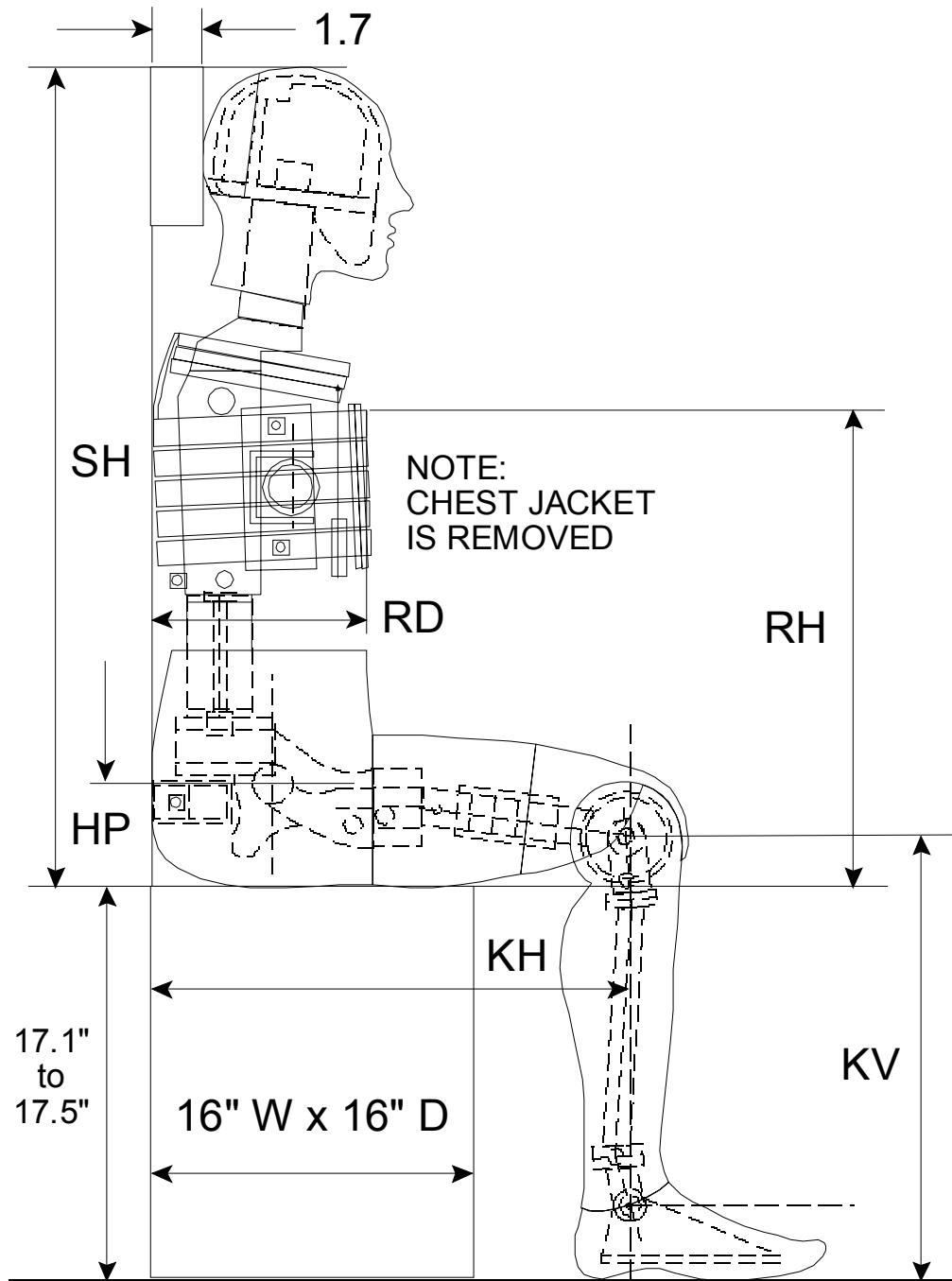


FIGURE 60